

|                                                                                                             |                                |  |                                                |  |
|-------------------------------------------------------------------------------------------------------------|--------------------------------|--|------------------------------------------------|--|
| <b>Index of Claims</b><br> | <b>Application/Control No.</b> |  | <b>Applicant(s)/Patent under Reexamination</b> |  |
|                                                                                                             | 11/138,323                     |  | KWAK ET AL.                                    |  |
|                                                                                                             | <b>Examiner</b>                |  | <b>Art Unit</b>                                |  |
|                                                                                                             | Hsien-ming Lee                 |  | 2823                                           |  |

|   |                 |
|---|-----------------|
| ✓ | <b>Rejected</b> |
| ≡ | <b>Allowed</b>  |

|   |                                        |
|---|----------------------------------------|
| — | <b>(Through numeral)<br/>Cancelled</b> |
| + | <b>Restricted</b>                      |

|   |                     |
|---|---------------------|
| N | <b>Non-Elected</b>  |
| I | <b>Interference</b> |

|   |                 |
|---|-----------------|
| A | <b>Appeal</b>   |
| O | <b>Objected</b> |

| Claim |          | Date    |  |  |  |  |  |  |  |  |  |
|-------|----------|---------|--|--|--|--|--|--|--|--|--|
| Final | Original | 1/20/07 |  |  |  |  |  |  |  |  |  |
|       | 1        | h       |  |  |  |  |  |  |  |  |  |
|       | 2        | h       |  |  |  |  |  |  |  |  |  |
|       | 3        | h       |  |  |  |  |  |  |  |  |  |
|       | 4        | h       |  |  |  |  |  |  |  |  |  |
|       | 5        | h       |  |  |  |  |  |  |  |  |  |
|       | 6        | h       |  |  |  |  |  |  |  |  |  |
|       | 7        | h       |  |  |  |  |  |  |  |  |  |
|       | 8        | h       |  |  |  |  |  |  |  |  |  |
|       | 9        | h       |  |  |  |  |  |  |  |  |  |
|       | 10       | h       |  |  |  |  |  |  |  |  |  |
|       | 11       | h       |  |  |  |  |  |  |  |  |  |
|       | 12       | h       |  |  |  |  |  |  |  |  |  |
|       | 13       | h       |  |  |  |  |  |  |  |  |  |
|       | 14       | h       |  |  |  |  |  |  |  |  |  |
|       | 15       | h       |  |  |  |  |  |  |  |  |  |
|       | 16       | h       |  |  |  |  |  |  |  |  |  |
|       | 17       |         |  |  |  |  |  |  |  |  |  |
|       | 18       |         |  |  |  |  |  |  |  |  |  |
|       | 19       |         |  |  |  |  |  |  |  |  |  |
|       | 20       |         |  |  |  |  |  |  |  |  |  |
|       | 21       |         |  |  |  |  |  |  |  |  |  |
|       | 22       |         |  |  |  |  |  |  |  |  |  |
|       | 23       |         |  |  |  |  |  |  |  |  |  |
|       | 24       |         |  |  |  |  |  |  |  |  |  |
|       | 25       |         |  |  |  |  |  |  |  |  |  |
|       | 26       |         |  |  |  |  |  |  |  |  |  |
|       | 27       |         |  |  |  |  |  |  |  |  |  |
|       | 28       |         |  |  |  |  |  |  |  |  |  |
|       | 29       |         |  |  |  |  |  |  |  |  |  |
|       | 30       |         |  |  |  |  |  |  |  |  |  |
|       | 31       |         |  |  |  |  |  |  |  |  |  |
|       | 32       |         |  |  |  |  |  |  |  |  |  |
|       | 33       |         |  |  |  |  |  |  |  |  |  |
|       | 34       |         |  |  |  |  |  |  |  |  |  |
|       | 35       |         |  |  |  |  |  |  |  |  |  |
|       | 36       |         |  |  |  |  |  |  |  |  |  |
|       | 37       |         |  |  |  |  |  |  |  |  |  |
|       | 38       |         |  |  |  |  |  |  |  |  |  |
|       | 39       |         |  |  |  |  |  |  |  |  |  |
|       | 40       |         |  |  |  |  |  |  |  |  |  |
|       | 41       |         |  |  |  |  |  |  |  |  |  |
|       | 42       |         |  |  |  |  |  |  |  |  |  |
|       | 43       |         |  |  |  |  |  |  |  |  |  |
|       | 44       |         |  |  |  |  |  |  |  |  |  |
|       | 45       |         |  |  |  |  |  |  |  |  |  |
|       | 46       |         |  |  |  |  |  |  |  |  |  |
|       | 47       |         |  |  |  |  |  |  |  |  |  |
|       | 48       |         |  |  |  |  |  |  |  |  |  |
|       | 49       |         |  |  |  |  |  |  |  |  |  |
|       | 50       |         |  |  |  |  |  |  |  |  |  |

| Claim |          | Date |  |  |  |  |  |  |  |  |  |
|-------|----------|------|--|--|--|--|--|--|--|--|--|
| Final | Original |      |  |  |  |  |  |  |  |  |  |
|       | 51       |      |  |  |  |  |  |  |  |  |  |
|       | 52       |      |  |  |  |  |  |  |  |  |  |
|       | 53       |      |  |  |  |  |  |  |  |  |  |
|       | 54       |      |  |  |  |  |  |  |  |  |  |
|       | 55       |      |  |  |  |  |  |  |  |  |  |
|       | 56       |      |  |  |  |  |  |  |  |  |  |
|       | 57       |      |  |  |  |  |  |  |  |  |  |
|       | 58       |      |  |  |  |  |  |  |  |  |  |
|       | 59       |      |  |  |  |  |  |  |  |  |  |
|       | 60       |      |  |  |  |  |  |  |  |  |  |
|       | 61       |      |  |  |  |  |  |  |  |  |  |
|       | 62       |      |  |  |  |  |  |  |  |  |  |
|       | 63       |      |  |  |  |  |  |  |  |  |  |
|       | 64       |      |  |  |  |  |  |  |  |  |  |
|       | 65       |      |  |  |  |  |  |  |  |  |  |
|       | 66       |      |  |  |  |  |  |  |  |  |  |
|       | 67       |      |  |  |  |  |  |  |  |  |  |
|       | 68       |      |  |  |  |  |  |  |  |  |  |
|       | 69       |      |  |  |  |  |  |  |  |  |  |
|       | 70       |      |  |  |  |  |  |  |  |  |  |
|       | 71       |      |  |  |  |  |  |  |  |  |  |
|       | 72       |      |  |  |  |  |  |  |  |  |  |
|       | 73       |      |  |  |  |  |  |  |  |  |  |
|       | 74       |      |  |  |  |  |  |  |  |  |  |
|       | 75       |      |  |  |  |  |  |  |  |  |  |
|       | 76       |      |  |  |  |  |  |  |  |  |  |
|       | 77       |      |  |  |  |  |  |  |  |  |  |
|       | 78       |      |  |  |  |  |  |  |  |  |  |
|       | 79       |      |  |  |  |  |  |  |  |  |  |
|       | 80       |      |  |  |  |  |  |  |  |  |  |
|       | 81       |      |  |  |  |  |  |  |  |  |  |
|       | 82       |      |  |  |  |  |  |  |  |  |  |
|       | 83       |      |  |  |  |  |  |  |  |  |  |
|       | 84       |      |  |  |  |  |  |  |  |  |  |
|       | 85       |      |  |  |  |  |  |  |  |  |  |
|       | 86       |      |  |  |  |  |  |  |  |  |  |
|       | 87       |      |  |  |  |  |  |  |  |  |  |
|       | 88       |      |  |  |  |  |  |  |  |  |  |
|       | 89       |      |  |  |  |  |  |  |  |  |  |
|       | 90       |      |  |  |  |  |  |  |  |  |  |
|       | 91       |      |  |  |  |  |  |  |  |  |  |
|       | 92       |      |  |  |  |  |  |  |  |  |  |
|       | 93       |      |  |  |  |  |  |  |  |  |  |
|       | 94       |      |  |  |  |  |  |  |  |  |  |
|       | 95       |      |  |  |  |  |  |  |  |  |  |
|       | 96       |      |  |  |  |  |  |  |  |  |  |
|       | 97       |      |  |  |  |  |  |  |  |  |  |
|       | 98       |      |  |  |  |  |  |  |  |  |  |
|       | 99       |      |  |  |  |  |  |  |  |  |  |
|       | 100      |      |  |  |  |  |  |  |  |  |  |

| Claim |          | Date |  |  |  |  |  |  |  |  |  |
|-------|----------|------|--|--|--|--|--|--|--|--|--|
| Final | Original |      |  |  |  |  |  |  |  |  |  |
|       | 101      |      |  |  |  |  |  |  |  |  |  |
|       | 102      |      |  |  |  |  |  |  |  |  |  |
|       | 103      |      |  |  |  |  |  |  |  |  |  |
|       | 104      |      |  |  |  |  |  |  |  |  |  |
|       | 105      |      |  |  |  |  |  |  |  |  |  |
|       | 106      |      |  |  |  |  |  |  |  |  |  |
|       | 107      |      |  |  |  |  |  |  |  |  |  |
|       | 108      |      |  |  |  |  |  |  |  |  |  |
|       | 109      |      |  |  |  |  |  |  |  |  |  |
|       | 110      |      |  |  |  |  |  |  |  |  |  |
|       | 111      |      |  |  |  |  |  |  |  |  |  |
|       | 112      |      |  |  |  |  |  |  |  |  |  |
|       | 113      |      |  |  |  |  |  |  |  |  |  |
|       | 114      |      |  |  |  |  |  |  |  |  |  |
|       | 115      |      |  |  |  |  |  |  |  |  |  |
|       | 116      |      |  |  |  |  |  |  |  |  |  |
|       | 117      |      |  |  |  |  |  |  |  |  |  |
|       | 118      |      |  |  |  |  |  |  |  |  |  |
|       | 119      |      |  |  |  |  |  |  |  |  |  |
|       | 120      |      |  |  |  |  |  |  |  |  |  |
|       | 121      |      |  |  |  |  |  |  |  |  |  |
|       | 122      |      |  |  |  |  |  |  |  |  |  |
|       | 123      |      |  |  |  |  |  |  |  |  |  |
|       | 124      |      |  |  |  |  |  |  |  |  |  |
|       | 125      |      |  |  |  |  |  |  |  |  |  |
|       | 126      |      |  |  |  |  |  |  |  |  |  |
|       | 127      |      |  |  |  |  |  |  |  |  |  |
|       | 128      |      |  |  |  |  |  |  |  |  |  |
|       | 129      |      |  |  |  |  |  |  |  |  |  |
|       | 130      |      |  |  |  |  |  |  |  |  |  |
|       | 131      |      |  |  |  |  |  |  |  |  |  |
|       | 132      |      |  |  |  |  |  |  |  |  |  |
|       | 133      |      |  |  |  |  |  |  |  |  |  |
|       | 134      |      |  |  |  |  |  |  |  |  |  |
|       | 135      |      |  |  |  |  |  |  |  |  |  |
|       | 136      |      |  |  |  |  |  |  |  |  |  |
|       | 137      |      |  |  |  |  |  |  |  |  |  |
|       | 138      |      |  |  |  |  |  |  |  |  |  |
|       | 139      |      |  |  |  |  |  |  |  |  |  |
|       | 140      |      |  |  |  |  |  |  |  |  |  |
|       | 141      |      |  |  |  |  |  |  |  |  |  |
|       | 142      |      |  |  |  |  |  |  |  |  |  |
|       | 143      |      |  |  |  |  |  |  |  |  |  |
|       | 144      |      |  |  |  |  |  |  |  |  |  |
|       | 145      |      |  |  |  |  |  |  |  |  |  |
|       | 146      |      |  |  |  |  |  |  |  |  |  |
|       | 147      |      |  |  |  |  |  |  |  |  |  |
|       | 148      |      |  |  |  |  |  |  |  |  |  |
|       | 149      |      |  |  |  |  |  |  |  |  |  |
|       | 150      |      |  |  |  |  |  |  |  |  |  |



## UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
 United States Patent and Trademark Office  
 Address: COMMISSIONER FOR PATENTS  
 P.O. Box 1450  
 Alexandria, Virginia 22313-1450  
 www.uspto.gov



Bib Data Sheet

CONFIRMATION NO. 9963

|                                                                                                                                                                                                                                                  |                                                                                                                   |                                               |                                                                                                                                                                                                                                                                                 |                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| <b>SERIAL NUMBER</b><br>11/138,323                                                                                                                                                                                                               | <b>FILING OR 371(c) DATE</b><br>05/27/2005<br><b>RULE</b>                                                         | <b>CLASS</b><br>257                           | <b>GROUP ART UNIT</b><br>2823                                                                                                                                                                                                                                                   | <b>ATTORNEY DOCKET NO.</b><br>61610533US |
| <b>APPLICANTS</b><br>Won-Kyu Kwak, Suwon-si, KOREA, REPUBLIC OF;<br>Kwan-Hee Lee, Suwon-si, KOREA, REPUBLIC OF;<br>Seung-Yong Song, Suwon-si, KOREA, REPUBLIC OF;                                                                                |                                                                                                                   |                                               |                                                                                                                                                                                                                                                                                 |                                          |
| <b>** CONTINUING DATA *****</b> <i>None</i> <i>Lee</i>                                                                                                                                                                                           |                                                                                                                   |                                               |                                                                                                                                                                                                                                                                                 |                                          |
| <b>** FOREIGN APPLICATIONS *****</b> <i>Lee</i><br>REPUBLIC OF KOREA 10-2004-0038735 05/29/2004 <i>Yes</i>                                                                                                                                       |                                                                                                                   |                                               |                                                                                                                                                                                                                                                                                 |                                          |
| <b>IF REQUIRED, FOREIGN FILING LICENSE GRANTED</b><br><b>** 06/28/2005</b>                                                                                                                                                                       |                                                                                                                   |                                               |                                                                                                                                                                                                                                                                                 |                                          |
| Foreign Priority claimed <input checked="" type="checkbox"/> yes <input type="checkbox"/> no<br>35 USC 119 (a-d) conditions met <input checked="" type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> Met after Allowance |                                                                                                                   | <b>STATE OR COUNTRY</b><br>KOREA, REPUBLIC OF | <b>SHEETS DRAWING</b><br>10                                                                                                                                                                                                                                                     | <b>TOTAL CLAIMS</b><br>15                |
| Verified and Acknowledged <i>Signature</i> <i>Initials</i>                                                                                                                                                                                       |                                                                                                                   |                                               |                                                                                                                                                                                                                                                                                 | <b>INDEPENDENT CLAIMS</b><br>4           |
| <b>ADDRESS</b><br>58027                                                                                                                                                                                                                          |                                                                                                                   |                                               |                                                                                                                                                                                                                                                                                 |                                          |
| <b>TITLE</b><br>Electroluminescence display device and method of manufacturing the same                                                                                                                                                          |                                                                                                                   |                                               |                                                                                                                                                                                                                                                                                 |                                          |
| <b>FILING FEE RECEIVED</b><br>1330                                                                                                                                                                                                               | FEES: Authority has been given in Paper<br>No. _____ to charge/credit DEPOSIT ACCOUNT<br>No. _____ for following: |                                               | <input type="checkbox"/> All Fees<br><input type="checkbox"/> 1.16 Fees ( Filing )<br><input type="checkbox"/> 1.17 Fees ( Processing Ext. of time )<br><input type="checkbox"/> 1.18 Fees ( Issue )<br><input type="checkbox"/> Other _____<br><input type="checkbox"/> Credit |                                          |

**Search Notes**

Application/Control No.

11/138,323

Examiner

Hsien-ming Lee

Applicant(s)/Patent under  
Reexamination

KWAK ET AL.

Art Unit

2823

**SEARCHED**

| Class | Subclass | Date      | Examiner |
|-------|----------|-----------|----------|
| 257   | 40,59    | 1/20/2007 | LEE      |
| 257   | 66,72    | 1/20/2007 | LEE      |
| 438   | 82,99    | 1/20/2007 | LEE      |
| 438   | 48,149   | 1/20/2007 | LEE      |
| 438   | 157      | 1/20/2007 | LEE      |
|       |          |           |          |
|       |          |           |          |
|       |          |           |          |
|       |          |           |          |
|       |          |           |          |
|       |          |           |          |
|       |          |           |          |
|       |          |           |          |
|       |          |           |          |
|       |          |           |          |

**INTERFERENCE SEARCHED**

| Class | Subclass | Date | Examiner |
|-------|----------|------|----------|
|       |          |      |          |
|       |          |      |          |
|       |          |      |          |
|       |          |      |          |

**SEARCH NOTES  
(INCLUDING SEARCH STRATEGY)**

|                                                               | DATE      | EXMR |
|---------------------------------------------------------------|-----------|------|
| EAST attached (USPAT, USPG,<br>USOCR, EPO, JPO, IBM, Derwent) | 1/20/2007 | LEE  |
| interference search                                           | 1/20/2007 | LEE  |
|                                                               |           |      |
|                                                               |           |      |
|                                                               |           |      |
|                                                               |           |      |
|                                                               |           |      |
|                                                               |           |      |
|                                                               |           |      |
|                                                               |           |      |
|                                                               |           |      |

## EAST Search History

| Ref # | Hits | Search Query                                                                                                                 | DBs                                                 | Default Operator | Plurals | Time Stamp       |
|-------|------|------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|------------------|---------|------------------|
| L1    | 124  | (won with kyu with kwak) or (kwan with hee with Lee) or (seung with yong with song)                                          | US-PGPUB;<br>USPAT                                  | OR               | ON      | 2007/01/20 09:19 |
| L2    | 79   | 1 and pixel and electrode and organic                                                                                        | US-PGPUB;<br>USPAT                                  | OR               | ON      | 2007/01/20 09:25 |
| L3    | 37   | 2 and (power adj supply)                                                                                                     | US-PGPUB;<br>USPAT                                  | OR               | ON      | 2007/01/20 09:27 |
| L4    | 13   | 3 and electroluminescence                                                                                                    | US-PGPUB;<br>USPAT                                  | OR               | ON      | 2007/01/20 09:20 |
| L5    | 12   | 4 and @ad<"20050527"                                                                                                         | US-PGPUB;<br>USPAT                                  | OR               | ON      | 2007/01/20 09:23 |
| L6    | 12   | 5 and (via or hole or opening or trench or groove or aperture)                                                               | US-PGPUB;<br>USPAT                                  | OR               | ON      | 2007/01/20 09:26 |
| L7    | 9545 | pixel and electrode and (organic with (dielectric or insulating or insulative or insulator))                                 | US-PGPUB;<br>USPAT                                  | OR               | ON      | 2007/01/20 12:24 |
| L8    | 4360 | 7 and (electroluminescence or EL)                                                                                            | US-PGPUB;<br>USPAT                                  | OR               | ON      | 2007/01/20 12:24 |
| L9    | 4255 | 8 and (via or hole or opening or trench or groove or aperture)                                                               | US-PGPUB;<br>USPAT                                  | OR               | ON      | 2007/01/20 12:06 |
| L10   | 1430 | 9 and (power adj supply)                                                                                                     | US-PGPUB;<br>USPAT                                  | OR               | ON      | 2007/01/20 12:06 |
| L11   | 1420 | 10 and display                                                                                                               | US-PGPUB;<br>USPAT                                  | OR               | ON      | 2007/01/20 09:27 |
| L12   | 1062 | 11 and (second near5 electrode)                                                                                              | US-PGPUB;<br>USPAT                                  | OR               | ON      | 2007/01/20 12:13 |
| L13   | 641  | 12 and @ad<"20040529"                                                                                                        | US-PGPUB;<br>USPAT                                  | OR               | ON      | 2007/01/20 12:13 |
| L14   | 549  | 13 and ((via or hole or opening or groove or trench or aperture) with (dielectric or insulating or insulative or insulator)) | US-PGPUB;<br>USPAT                                  | OR               | ON      | 2007/01/20 09:29 |
| L15   | 672  | pixel and electrode and (organic with (dielectric or insulating or insulative or insulator))                                 | USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | ON      | 2007/01/20 12:05 |
| L16   | 118  | 15 and (electroluminescence or EL)                                                                                           | USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | ON      | 2007/01/20 12:06 |

## EAST Search History

|     |      |                                                                                                     |                                                     |    |    |                  |
|-----|------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------|----|----|------------------|
| L17 | 65   | 16 and (via or hole or opening or trench or groove or aperture)                                     | USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2007/01/20 12:06 |
| L18 | 4    | 17 and (power with supply)                                                                          | USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2007/01/20 12:06 |
| L19 | 1233 | 11 and (cathode or anode)                                                                           | US-PGPUB;<br>USPAT                                  | OR | ON | 2007/01/20 12:13 |
| L20 | 758  | 19 and @ad<"20040529"                                                                               | US-PGPUB;<br>USPAT                                  | OR | ON | 2007/01/20 12:33 |
| L21 | 201  | 20 not 13                                                                                           | US-PGPUB;<br>USPAT                                  | OR | ON | 2007/01/20 12:24 |
| L22 | 6091 | 257/40,59,66,72.ccls.                                                                               | US-PGPUB;<br>USPAT                                  | OR | ON | 2007/01/20 12:27 |
| L23 | 1492 | 22 and pixel and electrode and (organic with (dielectric or insulating or insulative or insulator)) | US-PGPUB;<br>USPAT                                  | OR | ON | 2007/01/20 12:30 |
| L24 | 761  | 23 and (electroluminescence or EL)                                                                  | US-PGPUB;<br>USPAT                                  | OR | ON | 2007/01/20 12:30 |
| L25 | 523  | 24 and @ad<"20040529"                                                                               | US-PGPUB;<br>USPAT                                  | OR | ON | 2007/01/20 12:30 |
| L26 | 403  | 25 not 13                                                                                           | US-PGPUB;<br>USPAT                                  | OR | ON | 2007/01/20 12:30 |
| L27 | 368  | 26 not 21                                                                                           | US-PGPUB;<br>USPAT                                  | OR | ON | 2007/01/20 12:30 |
| L28 | 255  | 27 and power                                                                                        | US-PGPUB;<br>USPAT                                  | OR | ON | 2007/01/20 12:25 |
| L29 | 63   | 27 and (power with supply)                                                                          | US-PGPUB;<br>USPAT                                  | OR | ON | 2007/01/20 12:30 |
| L30 | 4236 | 438/82,99,149,48,157.ccls.                                                                          | US-PGPUB;<br>USPAT                                  | OR | ON | 2007/01/20 12:30 |
| L31 | 615  | 30 and pixel and electrode and (organic with (dielectric or insulating or insulative or insulator)) | US-PGPUB;<br>USPAT                                  | OR | ON | 2007/01/20 12:30 |
| L32 | 309  | 31 and (electroluminescence or EL)                                                                  | US-PGPUB;<br>USPAT                                  | OR | ON | 2007/01/20 12:30 |
| L33 | 131  | 32 and (power with supply)                                                                          | US-PGPUB;<br>USPAT                                  | OR | ON | 2007/01/20 12:30 |
| L34 | 87   | 33 and @ad<"20040529"                                                                               | US-PGPUB;<br>USPAT                                  | OR | ON | 2007/01/20 12:30 |
| L35 | 38   | 34 not 13                                                                                           | US-PGPUB;<br>USPAT                                  | OR | ON | 2007/01/20 12:30 |

## EAST Search History

|     |    |                                                                                                                                                    |                    |    |    |                  |
|-----|----|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----|----|------------------|
| L36 | 21 | 35 not 21                                                                                                                                          | US-PGPUB;<br>USPAT | OR | ON | 2007/01/20 12:30 |
| L37 | 15 | 36 not 27                                                                                                                                          | US-PGPUB;<br>USPAT | OR | ON | 2007/01/20 12:31 |
| L38 | 75 | (pixel and electrode and power and (el or electroluminescence) and display and (hole or via or trench or aperture or opening ore groove)).<br>clm. | US-PGPUB;<br>USPAT | OR | ON | 2007/01/20 12:32 |
| L39 | 42 | 38 and @ad<"20040529"                                                                                                                              | US-PGPUB;<br>USPAT | OR | ON | 2007/01/20 12:33 |

DOCUMENT-IDENTIFIER: US 20050200270 A1

TITLE: Electroluminescence display device

----- KWIC -----

Abstract Paragraph - ABTX (1):

An electroluminescent display device may include a display area formed on one surface of a substrate. It may further include a first electrode layer, a second electrode layer, and an electroluminescent emission layer between the first and second electrode layers. It may also include an electrode power supply line that supplies electrode power to the display area. The electrode power supply line can be located at least partially on an outer periphery of the display area, and may directly contact the second electrode layer. An electrical component may be arranged under the electrode power supply line, and may have one or more conductive layers.

Title - TTL (1):

Electroluminescence display device

INVENTOR - INNM (1):

Kwak, Won-Kyu

INVENTOR - INNM (2):

Lee, Kwan-Hee

Summary of Invention Paragraph - BSTX (4):

[0003] The present invention relates to a flat panel display. More particularly, it relates to an electroluminescence display device that can increase the proportion of display area to substrate area and can reduce nonuniformity in luminance throughout the display area by reducing voltage drop that can occur when supplying voltage to electrodes.

Summary of Invention Paragraph - BSTX (6):

[0005] In displaying an image, a variety of display devices are used and, in recent years, there have been numerous kinds of display devices available. Among these display devices, the organic electroluminescent device (a flat emissive-type display device that does not require a separate emission device such as a backlight) has become popular because it enables highly is efficient operation with low power consumption and is capable of blue emission.

Summary of Invention Paragraph - BSTX (7):

[0006] The electroluminescence display device utilizes the light emission principle in which, when an electric field is applied between the two electrodes, electrons are injected from the cathode side and holes are injected from the anode side. The electrons are recombined with the holes in the light emitting layer to form an excited state and energy generated when the excited state returns to the ground state is emitted as light.

Summary of Invention Paragraph - BSTX (8):

[0007] In an electroluminescence display device, an organic electroluminescent portion includes several layers stacked on a substrate, including a first electrode, that is, an anode, an organic light-emitting portion, and a second electrode, that is, a cathode. The organic light-emitting portion includes an organic emission layer (EML), in which recombination of holes and electrons occurs to form excitons and generate light.

Summary of Invention Paragraph - BSTX (9):

[0008] In order to increase emission efficiency, it can be useful to facilitate migration of holes and electrons to an organic emission layer. To this end, an electron transport layer (ETL) may be disposed between the cathode and the organic emission layer, and a hole transport layer (HTL) may also be disposed between the anode and the organic emission layer. Also, a hole injection layer (HIL) may be disposed between the anode and the HTL, and an electron injection layer (EIL) may be disposed between the cathode and the ETL.

Summary of Invention Paragraph - BSTX (10):

[0009] There are passive matrix-type (PM) and active matrix-type (AM) organic electroluminescence display. The passive-matrix type EL device may be simply constructed such that anodes and cathodes are arranged in columns and rows. Scanning signals can be supplied to the cathodes from a row driver. A single row can be selected from a plurality of rows. Data signals can be applied to each pixel from a column driver. The active matrix type EL device controls signals input to each pixel using thin film transistors (TFTs) and is suitable for processing a large quantity of signals, and thus is widely used as a motion picture display device.

Summary of Invention Paragraph - BSTX (11):

[0010] In an organic/inorganic electroluminescent display device, particularly, in an active matrix type organic/inorganic electroluminescent device, a problem is presented that a proportion of a display area including

pixels relative to a substrate is reduced due to lay-out of various driving circuits and wirings substrate.

Summary of Invention Paragraph - BSTX (12):

[0011] FIG. 1A is a plan view of a general active matrix type electroluminescence display device. FIG. 1B is a cross-sectional view taken along the line I-I shown in FIG. 1A.

Summary of Invention Paragraph - BSTX (13):

[0012] The active matrix type electroluminescence display device shown in FIGS. 1A and 1B includes a predetermined display area 20 having an organic electroluminescent device on a transparent insulating substrate 11. In order to seal the display area 20, a metal cap 90 may be sealed by a sealing portion 80 having a sealing member 81.

Summary of Invention Paragraph - BSTX (14):

[0013] The organic electroluminescent device including thin film transistors has a plurality of pixels arranged in the display area 20 and a cathode electrode 40 disposed on the display area 20. The cathode electrode 40 can be connected to an external terminal region 70 through an electrode wiring portion 41 provided at one side of the display area 20. Also, the display area 20 can have a plurality of driving lines (VDD) 31 arranged thereon. The driving lines 31 are connected to the terminal region 70 through a driving power wiring portion 30 outside the display area 20, and supply driving power to the display area 20. Also, a vertical circuit portion 50 and a horizontal circuit portion 60 for applying signals to TFTs of the display area 20 are further provided outside the display area 20, and are both connected to the terminal region 70 by circuit wiring portions 51 and 61, respectively.

Summary of Invention Paragraph - BSTX (15):

[0014] In the aforementioned active matrix type electroluminescence display device, the metal cap 90 as a sealing member seals the entire region excluding the terminal region 70, including the wiring portions 51 and 61 and the circuit portions 50 and 60 as well as the display area 20. As a result, the sealing portion 80 encapsulates not only the display area 20, which is an image display portion, but also a non-image display portion, that is, the wiring portions 51 and 61 and the circuit portions 50 and 60. This lowers a proportion of the display area 20 relative to the overall size of the display device, resulting in an increase in dead space (i.e. non-emissive region).

Summary of Invention Paragraph - BSTX (16):

[0015] The above-noted problems are described in Korean Patent Publication

No. 2001-83213. Here, a protective electrode as a cathode is connected to an external FPC through a wiring structure disposed at the edge of a sealing portion, occupying a considerable area of the edge of the sealing portion.

Summary of Invention Paragraph - BSTX (17):

[0016] To overcome such a lay-out problem, the electroluminescence display device shown in FIGS. 1A and 1B is constructed such that a width of the wiring portion 51, 61 that connects the display area 20 and the terminal region 70 is reduced. This design, however, increases resistance of the wiring portion 51, 61, resulting in deterioration of luminance.

Summary of Invention Paragraph - BSTX (18):

[0017] Japanese Patent Publication No. 2003-316284 discloses a liquid crystal display device with a reduced panel size, in which liquid crystals are injected between a substrate having common electrodes arranged thereon and a substrate having pixel electrodes arranged thereon to then be sealed. A gap between the substrates provided for injection of the liquid crystals may cause a step difference between the common electrodes and power supply lines for supplying power to the common electrodes, and disconnection between the common electrodes and the power supply lines may occur due to such a step difference. This disconnection may result in a considerable voltage drop, leading to deterioration of luminance in the display area.

Summary of Invention Paragraph - BSTX (21):

[0019] The present invention provides, for example, an electroluminescent display device including a display area formed on one surface of a substrate with a first electrode layer and a second electrode layer (each of which consists of one or more layers respectively), as well as an electroluminescent portion having an emission layer between the first and second electrode layers. It can also include an electrode power supply line that supplies electrode power to the display area with one or more layers arranged along at least a portion of an outer periphery of the display area, and with at least a portion contacting the second electrode layer directly. It can further include an electrical component that has one or more conductive layer arranged under the electrode power supply line.

Summary of Invention Paragraph - BSTX (22):

[0020] A pixel definition layer of the display area may extend to be interposed between the second electrode layer and the electrode power supply line. The second electrode layer and the electrode power supply line may directly contact each other through an opening formed on at least a portion of the pixel definition layer over the electrode power supply line. The opening

may be formed as a closed curve along an outer periphery of the display area.

Summary of Invention Paragraph - BSTX (23):

[0021] The second **electrode** layer and the **electrode power supply** line may be in plane-contact. The electrical component may include a driver circuit portion for applying an electric signal to the display area. The electrical component may include a driving **power supply** line for supplying driving power to the display area. The light generated from the emission layer may be emitted through the substrate.

Summary of Invention Paragraph - BSTX (24):

[0022] Alternatively, the light generated from the emission layer may be emitted through a sealing substrate (e.g. a substrate for establishing a seal together with the substrate). In this case, the first **electrode** layer can include one or more layers containing a conductive reflective film. The **electrode power supply** line may be formed of one or more layers, and may contain the conductive reflective film. The conductive reflective film may be a metal layer. The conductive reflective film may have a thickness of approximately 1000 .ANG. or greater.

Brief Description of Drawings Paragraph - DRTX

(2):

[0023] FIG. 1A is a schematic plan view of a conventional **electroluminescence** display device.

Brief Description of Drawings Paragraph - DRTX

(4):

[0025] FIG. 2A is a schematic plan view of an **electroluminescence** display device according to an embodiment of the present invention.

Brief Description of Drawings Paragraph - DRTX

(6):

[0027] FIG. 3 is a schematic plan view of an **electroluminescence** display device according to another embodiment of the present invention.

Brief Description of Drawings Paragraph - DRTX

(7):

[0028] FIG. 4A is a schematic plan view of an **electroluminescence** display device according to another embodiment of the present invention.

Brief Description of Drawings Paragraph - DRTX

(9):

[0030] FIG. 5A is a schematic plan view of an electroluminescence display device according to still another embodiment of the present invention.

Detail Description Paragraph - DETX (3):

[0033] As shown in FIG. 2A, on one plane of a substrate 110 the following are provided: a display area 200 where a light-emitting device (such as an electroluminescence display device) is disposed, a sealing portion 800 coated on an outer periphery of the display area 200 (for sealing a substrate 110 and an sealing substrate (900 shown in FIG. 2B)), and a terminal region 700 having various terminals. The sealing substrate 900 may be replaced by a sealing thin film layer.

Detail Description Paragraph - DETX (4):

[0034] A structure of the electroluminescence display device forming the display area 200 will be described with reference to FIG. 2B. A buffer layer 120 made of SiO.sub.2 may be formed on a substrate (for example, a glass substrate 110). A semiconductor active layer 130 may be formed on one plane of the buffer layer 120. The semiconductor active layer 130 may be an amorphous silicon layer or a polycrystalline silicon layer. Although not shown in detail, the semiconductor active layer 130 includes source and drain regions doped with N+ type or P+ type dopants, and a channel region. The semiconductor active layer 130 may include, but is not limited to an organic semiconductor.

Detail Description Paragraph - DETX (5):

[0035] A gate electrode 150 may be formed at a location corresponding to the channel region on one plane of the semiconductor active layer 130. The channel region may be electrically connected or disconnected according to signal applied to the gate electrode 150, by which source and drain regions are connected to each other.

Detail Description Paragraph - DETX (6):

[0036] The gate electrode 150 may preferably be formed of MoW, Al/Cu, or the like, in view of adhesion to adjacent layers, planarity of the surface on which the gate electrode 150 is stacked, processability, and so on. In order to ensure insulating properties of the semiconductor active layer 130 and the gate electrode 150, a gate insulating layer 140 made of silicon oxide (SiO.sub.2) may be interposed between the semiconductor active layer 130 and the gate electrode 150. This may be accomplished, for example, by plasma enhanced chemical vapor deposition (PECVD).

Detail Description Paragraph - DETX (7):

[0037] An interlayer 160 may be formed on the gate electrode 150. The

interlayer 160 may be a single layer or double layers made of a material such as SiO<sub>2</sub> or SiN<sub>x</sub>. Source/drain **electrodes** 170 may be formed on the interlayer 160. The source/drain **electrodes** 170 may be electrically connected to a source region and a drain region in the semiconductor active layer via contact holes formed in the interlayer 160 and the gate insulating layer 140, respectively.

Detail Description Paragraph - DETX (8):

[0038] A protective layer 180 (for example, a passivation layer or a planarization layer) that may serve as an insulating layer may be formed on the source/drain **electrodes** 170 and may protect or planarize underlying TFTs. The protective layer 180 of the illustrative embodiment of the present invention may be made of various materials. For example, the protective layer 180 may be formed of either an inorganic material or an **organic** material. Also, the protective layer 180 may have a single, or multi-layer (two or more layers) structure having a lower SiN<sub>x</sub> layer and an upper **organic** material layer made of benzocyclobutene (BCB) or acryl.

Detail Description Paragraph - DETX (9):

[0039] A first **electrode** layer 210 may be disposed on one plane of the protective layer 180. One end of the first **electrode** layer 210 may be connected to the drain **electrode** 170 formed beneath it. It may be connected through a via hole 211 formed in the protective layer 180. The first **electrode** layer 210, if it is of a bottom emission type, may, for example, be formed of a transparent **electrode** made of indium tin oxide (ITO). If it is a top emission type, the first **electrode** layer 210 may be formed of a variety of modified **electrodes**. For example, Mg:Ag/ITO may be deposited as the first **electrode** layer 210.

Detail Description Paragraph - DETX (10):

[0040] The **organic** electroluminescent portion 230 may include a low-molecular or high-molecular **organic** layer. When the low-molecular **organic** layer is used, a hole injection layer (HIL), a hole transport layer (HTL), an **organic** emission layer (EML), an electron transport layer (ETL), or an electron injection layer (EIL) may be stacked in a single or composite structure. Various **organic** materials, including copper phthalocyanine (CuPc), N,N'-Di(naphthalene-1-yl)-N,N'-diphenyl-benzidine (NPB), tris-8-hydroxyquinoline aluminum (Alq<sub>3</sub>) and the like, can be used. These low-molecular **organic** layers can be formed by vacuum deposition.

Detail Description Paragraph - DETX (11):

[0041] When the high-molecular **organic** layer is used, the **organic**

electroluminescent portion 230 usually has a hole transport layer (HTL) and an **organic** emission layer (EML). In this case, PEDOT may be used as the hole transport layer, and poly-phenylenevinylene based (PPV) or polyfluorene based high-molecular **organic** material can be used as an emission layer. Screen printing or inkjet printing may be employed to form these layers.

Detail Description Paragraph - DETX (12):

[0042] A cathode **electrode** 400 may be entirely deposited on one plane of the **organic** electroluminescent portion 230. According to emission type, Al/Ca, ITO, or Mg--Ag may also be used for the cathode **electrode** 400. The cathode **electrode** 400 may be formed of multiple layers rather than a single layer. Also, the cathode **electrode** 400 may further include an alkali or alkali earth metal fluoride layer, e.g., an LiF layer, or other various types of layers.

Detail Description Paragraph - DETX (13):

[0043] As shown in FIG. 2A, a driving **power supply** line 300 for supplying driving power to the display area 200 may be provided between the display area 200 and the sealing portion 800. FIG. 2A shows the arrangement of a driving **power supply** line according to an exemplary embodiment of the present invention. However, the invention is not limited to the illustrative arrangement, but driving power may be uniformly distributed throughout the display area to solve the problem of nonuniformity in luminance.

Detail Description Paragraph - DETX (14):

[0044] Thus, the driving **power supply** line 300 may be formed so as to surround the display area. The driving **power supply** line 300 may be connected to a driving line 310. The driving line 310 may be arranged across the display area 200 and may be electrically connected to the source **electrode** (170 shown in FIG. 2B) disposed under the protective layer 180.

Detail Description Paragraph - DETX (16):

[0046] Meanwhile, an **electrode power supply** line 410 for supplying **electrode** power to the display area 200 may be provided at least at a portion along the outer periphery of the display area 200. The **electrode power supply** line 410 may be formed of the same material as the first **electrode** layer 210 of the display area 200. That is, the **electrode power supply** line 410 may be formed simultaneously with the first **electrode** layer 210.

Detail Description Paragraph - DETX (17):

[0047] Also, the **electrode power supply** line 410 may be brought into direct contact with a second **electrode** layer 400 to be formed in a subsequent step, which may help solve problems with the prior art due to poor contact or voltage

drop. Also, an electrical component having one or more conductive layers (for example, a vertical driver 500) may be provided at the lower portion of the electrode power supply line 410. Thus, unlike in the prior art in which electrode power supply lines are independently arranged so as not to overlap with other components, the electrode power supply line 410 according to an embodiment of the present invention may be arranged over the electrical component (e.g., the vertical driver 500). This obviates the need for specially arranging the electrode power supply line 400 that was present in the prior art. Thus, the ratio of display area to substrate can be improved. This can be implemented by using a smaller substrate for the same display size, or a larger display size for the same substrate.

Detail Description Paragraph - DETX (18):

[0048] The electrode power supply line 410 and the second electrode layer 400 may be electrically connected to each other by various methods. In order to prevent voltage drop due to contact resistance between the electrode power supply line 410 and the second electrode layer 400, the electrode power supply line 410 and the second electrode layer 400 may be electrically connected to each other in a plane-contact manner (surface-contact manner). That is, a contact region between the second electrode layer and electrode power supply line may occupy substantially the width of the electrode power supply line 410.

Detail Description Paragraph - DETX (19):

[0049] As shown in FIG. 2B, a pixel definition layer 220 that defines a pixel region of a display area 200 may extend to be interposed between the second electrode layer 400 and the electrode power supply line 410. The second electrode layer 400 may extend over the electrode power supply line 410 toward the outer periphery of the display area 200. An opening 430 may be formed on at least a portion of the pixel definition layer 220 over the electrode power supply line 410. The second electrode layer 400 and the electrode power supply line 410 may directly contact each other, preferably in a plane-contact manner, at the opening 430.

Detail Description Paragraph - DETX (20):

[0050] FIG. 2A shows the electrode power supply line 410 as an electrical component including one or more conductive layers among conductive layers in the display area 200. The electrode power supply line 410 can overlap the vertical driver 500 when viewed in a direction from the sealing substrate 900 to the substrate 110.

Detail Description Paragraph - DETX (21):

[0051] As shown in FIG. 3, the electrode power supply line 410 may be

disposed over a horizontal circuit portion 600 for applying a data signal to the display area 210. Alternatively, the **electrode power supply** line 410 may also be disposed in various manners, overlapping other wiring. A variety of modifications are possible depending on the lay-out designs of various driver circuits.

Detail Description Paragraph - DETX (22):

[0052] As shown in FIGS. 4A and 4B, the driving **power supply** line 300 may be selected as an electrical component having the **electrode power supply** line 410 disposed thereon. That is, the vertical driver 500 may be disposed at an outer periphery of the display area 200, the driving **power supply** line 300 may be disposed between the vertical driver 500 and the sealing portion 800, and the **electrode power supply** line 410 may be formed above at least a portion of the driving **power supply** line 300 simultaneously with the first **electrode** layer 210 of the display area 200.

Detail Description Paragraph - DETX (23):

[0053] The **pixel** definition layer 220 may be formed above the first **electrode** layer 210. The **pixel** definition layer 220 can cover at least a portion of the **electrode power supply** line 410, and may be interposed between the second **electrode** layer 400 and the **electrode power supply** line 410 (typically not yet formed when the **pixel** definition layer 220 is formed). An opening 430 may be formed on at least a portion of the driving **power supply** line 300 simultaneously with a **pixel** region of the display area 200.

Detail Description Paragraph - DETX (24):

[0054] The second **electrode** layer 400 can contact the **power supply** line 410 at the opening 430 in a direct contact manner, such as a plane-contact manner. That is, a contact between the second **electrode** layer 400 and the **electrode power supply** line 410 may occur over the driving **power supply** line 300.

Detail Description Paragraph - DETX (25):

[0055] In the above-described embodiments, in order to avoid interference between overlapping components, an insulating layer such as the protective layer 180 may be interposed between each of the **electrode power supply** line 410 and its underlying electrical components (for example, the vertical and horizontal drivers 500 and 600, the driving **power supply** line 410, and various other wirings).

Detail Description Paragraph - DETX (26):

[0056] The **electrode power supply** line may be formed on at least a portion of the outer periphery of the display area 200. The precise formation does not

have to imitate what is shown in the figures.

Detail Description Paragraph - DETX (27):

[0057] If an **electrode power supply** is provided only at a side of the second **electrode** layer, a different voltage drop may be generated depending on the position of the second **electrode** layer. This voltage drop may cause luminance nonuniformity. In order to try to overcome this problem, the **electrode power supply** line and the second **electrode** layer can be arranged such that they contact symmetrically at both sides of the second **electrode** layer.

Detail Description Paragraph - DETX (28):

[0058] As shown in FIG. 4A, the **electrode power supply** line and the second **electrode** layer may preferably be disposed to form a closed curve. Also, if the **pixel** definition layer 220 extends to be interposed between the **electrode power supply** line 410 and the second **electrode** layer 400, a closed curve may be formed at the opening 430 where the **electrode power supply** line 410 and the second **electrode** layer 400 directly contact each other.

Detail Description Paragraph - DETX (29):

[0059] The **electrode power supply** line 410 and the second **electrode** layer 400 may contact in a plane-contact manner closed curve. This may reduce the voltage drop generated when **electrode** power is supplied. Consequently the problem of luminance nonuniformity in the display area may be alleviated. This arrangement may be particularly advantageous in a front emission type EL device. This may be because a transparent **electrode** made, for example, of ITO(which is weak in conductivity) may be typically used as the second **electrode** layer 400. However, the electroluminescent display device according to the present invention is not limited to a front emission type.

Detail Description Paragraph - DETX (30):

[0060] In another embodiment of the present invention, a front emission type EL device may comprise a first **electrode** layer 210 including one or more layers having at least a conductive reflective film. For example, the first **electrode** layer 210 may be prepared by forming a conductive reflective film having Al, Ag, or an alloy thereof entirely deposited thereon, and forming multiple layers of metal and/or metal oxide of Ni, Ir, Pt, Au, ITO, or IZO on the conductive reflective film. The structure of the first **electrode** layer 210 is not limited to the types described above and may have various types. In some cases, first **electrode** layer 210 may further include metal and/or metal oxide layers, e.g., Ni, ITO, or IZO, that are formed prior to formation of the conductive reflective film.

Detail Description Paragraph - DETX (31):

[0061] In this case, in order to ensure conductivity of the electrode power supply line 410, the electrode power supply line 410 may include at least a layer formed of the same material as the conductive reflective film of the first electrode layer 210. In other cases, the electrode power supply line 410 may include only the layer formed of the same material as the conductive reflective film of the first electrode layer 210.

Detail Description Paragraph - DETX (32):

[0062] If the electrode power supply line 410 includes a layer formed of the same material as the conductive reflective film of the first electrode layer 210, the conductive reflective film may be approximately 1000 .ANG. or more thick. This may help to make the electrode power supply line 410 function properly by preventing an increase in contact resistance. In view of the processing requirements and the overall thickness dimensions, approximately 3000 .ANG. may be a preferred thickness.

Detail Description Paragraph - DETX (33):

[0063] In another embodiment of the present invention, in order to further increase the proportion of the display area 200 to the panel, the driving power supply line 300 may include one or more conductive layers. At least some of the conductive layers may be formed between the sealing portion 800 and the substrate.

Detail Description Paragraph - DETX (34):

[0064] As shown in FIGS. 5A and 5B, the driving power supply line 300 may be arranged so as to overlap a sealing portion 800 formed along an outer periphery of the display area 200. As shown in FIG. 5B, the driving power supply line 300 may be formed in the same plane as an interlayer 160 using the same material as that of source/drain electrode 170 of the display area 200. The configuration of the driving power supply line 300 is not limited to that shown in the illustrative embodiment, and can be modified as desired.

Detail Description Paragraph - DETX (35):

[0065] The driving power supply line 300 may include one or more layers formed of the same material as a semiconductor active layer 130, a gate electrode 150, or source/drain electrodes 170. When the driving power supply line 300 is formed of the same material as the source/drain electrodes 170, the driving power supply line 300 may be coated with a protective layer 180 so that the sealing member 810 and electric lines do not directly contact each other. This may help to prevent line damage due to contact with a sealing member 810.

Detail Description Paragraph - DETX (36):

[0066] As shown in FIG. 5A, the electrode power supply line 410 may overlap a driver circuit portion or the driving power supply line 300 that may overlap the sealing portion 800. This arrangement may further increase the ratio of display area to total panel size.

Detail Description Paragraph - DETX (37):

[0067] The above-described embodiments are provided only for illustrating the present invention and the present invention is not limited thereto. For example, the lay-out of the driving power supply line, the electrode power supply line, and the driver circuit portion can be changed or modified in various manners, while remaining within the scope of the present invention. While the embodiments have been shown and described with respect to organic electroluminescence display devices, the present invention can also be applied to other electroluminescent display devices without departing from the scope of the invention.

Claims Text - CLTX (2):

1. An electroluminescent display device, comprising: a display area formed on one surface of a substrate with a first electrode layer, a second electrode layer, and an electroluminescent emission layer between the first electrode layer and the second electrode layer; an electrode power supply line adapted to supply electrode power to the display area, including a layer arranged along at least a portion of an outer periphery of the display area, and in direct contact with the second electrode layer; and an electrical component arranged under the electrode power supply line, comprising a conductive layer.

Claims Text - CLTX (3):

2. The electroluminescent display device of claim 1, wherein the electrode power supply line comprises a same material as the first electrode layer.

Claims Text - CLTX (5):

4. The electroluminescent display device of claim 1, wherein the electrode power supply line comprises a closed curve along an outer periphery of the display area.

Claims Text - CLTX (6):

5. The electroluminescent display device of claim 1, wherein a pixel definition layer of the display area comprises an extension interposed between the second electrode layer and the electrode power supply line, and the second electrode layer and the electrode power supply line directly contact each other through an opening in the pixel definition layer over the electrode power

supply line.

Claims Text - CLTX (8):

7. The electroluminescent display device of claim 1, wherein the second electrode layer and the electrode power supply line are in plane contact.

Claims Text - CLTX (10):

9. The electroluminescent display device of claim 1, wherein the electrical component includes a driving power supply line for supplying driving power to the display area.

Claims Text - CLTX (13):

12. The electroluminescent display device of claim 1, wherein the first electrode layer comprises a conductive reflective film.

Claims Text - CLTX (16):

15. An electroluminescent display device comprising: a display area formed on one surface of a substrate with a first electrode layer, a second electrode layer, and an electroluminescent emission layer between the first electrode layer and the second electrode layer; a sealing portion for sealing at least the display area by a sealing member; an electrode power supply line adapted to supply electrode power to the display area, including a layer arranged along at least a portion of an outer periphery of the display area, and in direct contact with the second electrode layer; a driving power supply line that supplies driving power to the display area and that is disposed between the sealing portion and the substrate; and an electrical component arranged under the electrode power supply line, comprising a conductive layer.

Claims Text - CLTX (17):

16. The electroluminescent display device of claim 15, wherein the electrode power supply line comprises the same material as the first electrode layer.

Claims Text - CLTX (19):

18. The electroluminescent display device of claim 15, wherein the electrode power supply line comprises a closed curve along an outer periphery of the display area.

Claims Text - CLTX (20):

19. The electroluminescent display device of claim 15, wherein a pixel definition layer of the display area comprises an extension interposed between the second electrode layer and the electrode power supply line, and the second

electrode layer and the electrode power supply line directly contact each other through an opening in the pixel definition layer over the electrode power supply line.

Claims Text - CLTX (22):

21. The electroluminescent display device of claim 15, wherein the second electrode layer and the electrode power supply line are in plane contact state.

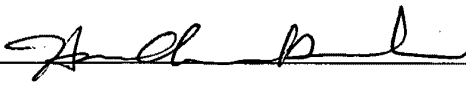
Claims Text - CLTX (26):

25. The electroluminescent display device of claim 24, wherein the first electrode layer comprises a conductive reflective film.



Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

|                                                                                                                                                                          |                        |               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------|
| <b>CHANGE OF<br/>CORRESPONDENCE ADDRESS</b><br><i>Application / Patent</i><br><br>Address to:<br>Commissioner for Patents<br>P.O. Box 1450<br>Alexandria, VA 22313-1450. | Application Number     | 11/138,323    |
|                                                                                                                                                                          | Filing Date            | May 27, 2005  |
|                                                                                                                                                                          | Patent Number          |               |
|                                                                                                                                                                          | Issue Date             |               |
|                                                                                                                                                                          | First Named Inventor   | KWAK, Won-Kyu |
|                                                                                                                                                                          | Attorney Docket Number | 61610533US    |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                        |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-----|
| Please change the Correspondence Address for the above-identified application / patent to:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                        |     |
| <input checked="" type="checkbox"/> The address associated with<br>Customer Number:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>58027</b>           |     |
| OR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |     |
| <input type="checkbox"/> Firm or<br>Individual Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                        |     |
| Address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                        |     |
| City                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | State                  | Zip |
| Country                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                        |     |
| Telephone                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Fax                    |     |
| <p>This form cannot be used to change the data associated with a Customer Number. To change the data associated with an existing Customer Number use "Request for Customer Number Data Change" (PTO/SB/124).</p> <p>I am the :</p> <p><input type="checkbox"/> Applicant/Inventor.</p> <p><input type="checkbox"/> Assignee of record of the entire interest.<br/>Certificate under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).</p> <p><input checked="" type="checkbox"/> Attorney or agent of record. Registration Number <u>50,114</u>.</p> <p><input type="checkbox"/> Registered practitioner named in the application transmittal letter in an application without an executed oath or declaration. See 37 CFR 1.33(a)(1). Registration Number ____.</p> |                        |     |
| Signature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                        |     |
| Typed or Printed Name Hae-Chan Park                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                        |     |
| Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Telephone 703-288-5105 |     |
| NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                        |     |
| <input checked="" type="checkbox"/> *Total of 1 forms are submitted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                        |     |

This collection of information is required by 37 CFR 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

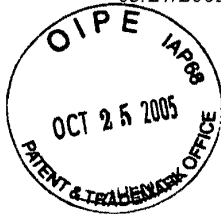


## UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
 United States Patent and Trademark Office  
 Address: COMMISSIONER FOR PATENTS  
 P.O. Box 1450  
 Alexandria, Virginia 22313-1450  
 www.uspto.gov

| APPLICATION NUMBER | FILING OR 371 (c) DATE | FIRST NAMED APPLICANT | ATTORNEY DOCKET NUMBER |
|--------------------|------------------------|-----------------------|------------------------|
| 11/138,323         | 05/27/2005             | Won-Kyu Kwak          | 6161.0533.US           |

23345  
 MCGUIREWOODS, LLP  
 1750 TYSONS BLVD  
 SUITE 1800  
 MCLEAN, VA 22102



CONFIRMATION NO. 9963  
 FORMALITIES  
 LETTER

Date Mailed: 09/07/2005

## NOTICE OF OMITTED ITEM(S) IN A NONPROVISIONAL APPLICATION

## FILED UNDER 37 CFR 1.53(b)

A filing date has been accorded to the above-identified nonprovisional application papers; however, the following item(s) appear to have been omitted from the application:

- Figure(s) 2F described in the specification.

I. Should applicant contend that the above-noted omitted item(s) was in fact deposited in the U.S. Patent and Trademark Office (USPTO) with the nonprovisional application papers, a copy of this Notice and a petition (and \$400.00 petition fee (37 CFR 1.17(f))) with evidence of such deposit **must** be filed within **TWO MONTHS** of the date of this Notice. The petition fee will be refunded if it is determined that the item(s) was received by the USPTO.

II. Should applicant desire to supply the omitted item(s) and accept the date that such omitted item(s) was filed in the USPTO as the filing date of the above-identified application, a copy of this Notice, the omitted item(s) (with a supplemental oath or declaration in compliance with 37 CFR 1.63 and 1.64 referring to such items), and a petition under 37 CFR 1.182 (with the \$400.00 petition fee (37 CFR 1.17(f)) requesting the later filing date **must** be filed within **TWO MONTHS** of the date of this Notice.

Applicant is advised that generally the filing fee required for an application is the filing fee in effect on the filing date accorded the application and that payment of the requisite basic filing fee on a date later than the filing date of the application requires payment of a surcharge (37 CFR 1.16(f)). To avoid processing delays and payment of a surcharge, applicant should submit any balance due for the requisite filing fee based on the later filing date being requested when submitting the omitted items(s) and the petition (and petition fee) requesting the later filing date.

III. The failure to file a petition (and petition fee) under the above options (I) or (II) within **TWO MONTHS** of the date of this Notice (37 CFR 1.181(f)) will be treated as a constructive acceptance by the applicant of the application as deposited in the USPTO. **THIS TWO MONTH PERIOD IS NOT EXTENDABLE UNDER 37 CFR 1.136(a) or (b).** In the absence of a timely filed petition in reply to this Notice, the application will maintain a filing date as of the date of deposit of the application papers in the USPTO, and original application papers (*i.e.*, the original disclosure of the invention) will include only those application papers present in the USPTO on the date of deposit.

In the event that applicant elects not to take action pursuant to options (I) or (II) above (thereby constructively electing option (III)), amendment of the specification to renumber the pages consecutively and cancel incomplete sentences caused by any omitted page(s), and/or amendment of the specification to cancel all references to any

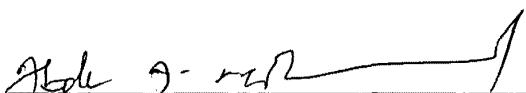
omitted drawing(s), relabel the drawing figures to be numbered consecutively (if necessary), and correct the references in the specification to the drawing figures to correspond with any relabeled drawing figures, is required. A copy of the drawing figures showing the proposed changes in red ink should accompany with any drawing changes. Such amendment and/or correction to the drawing figures, if necessary, should be by way of preliminary amendment submitted prior to the first Office action to avoid delays in the prosecution of the application.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Replies should be mailed to: Mail Stop Missing Parts  
Commissioner for Patents  
P.O. Box 1450  
Alexandria VA 22313-1450

---

*A copy of this notice **MUST** be returned with the reply.*



Office of Initial Patent Examination (571) 272-4000, or 1-800-PTO-9199, or 1-800-972-6382  
PART 2 - COPY TO BE RETURNED WITH RESPONSE



IFW

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

**In re Patent Application of:**

**Docket No.:** 6161.0533.US

Won-Kyu Kwak, *et al.*

**Serial No.:** 11/138,323

**Group Art Unit:** 2811

**Confirmation No.:** 9963

**Filed:** May 27, 2005

**Examiner:** TBD

**For: ELECTROLUMINESCENCE DISPLAY  
AND METHOD OF MANUFACTURING  
THE SAME**

Mail Stop: Missing Parts  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**PRELIMINARY AMENDMENT AND REPLY TO NOTICE OF OMITTED ITEM(S)**

Sir:

In response to the **Notice of Omitted Items** mailed September 7, 2005 ("Notice"), please enter the following Preliminary Amendment prior to examination of this non-provisional application.

- **Amendments to the Specification** begin at page 2.
- **Remarks** begin at page 3.
- **Conclusions** are set forth at page 3.

Applicants believe that no extensions of time are required at this time, but if extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned under 37 C.F.R. §1.136(a), and any fees required therefor (including fees for net addition of claims) are hereby authorized to be charged to **Deposit Account No. 23-1951** (McGuireWoods). Please charge any deficiencies in fees and credit any overpayment of fees to the same Deposit Account.

**AMENDMENT TO SPECIFICATION**

***In the Specification***

A marked-up copy of the changes to selected paragraph(s) is provided below. Please enter these changes to the specification in the record.

Please **AMEND** paragraph number [0018] as follows:

FIGS. 2B, 2C, 2D, and 2E, ~~and 2F~~ are cross-sectional views showing processes of manufacturing the organic EL display shown in FIG. 2A.

**REMARKS**

The Notice of Omitted Item(s) mailed September 7, 2005 has been received and its contents carefully analyzed. The Notice indicates that Figure 2F appears to have been omitted from the specification. In reply, Applicants note that the reference to Figure 2F in paragraph [0018] of the specification as originally filed is a typographical error. Applicants have therefore amended paragraph [0018] to delete the reference to Figure 2F.

This preliminary amendment does not add new matter or present any new issues that would require any further consideration and/or search by the Examiner. Accordingly, entry of the preliminary amendment and reconsideration of the application are respectfully requested.

### CONCLUSIONS

Applicants submit that a full and complete response has been made to the Notice of Omitted Item(s). The Office is therefore respectfully requested to pass the above application to examination.

It is believed that no new matter is added by this Preliminary Amendment. Should the Office feel that there are any issues outstanding after consideration of this Preliminary Amendment, the Office is invited to contact the Applicants' undersigned representative at the number listed below to expedite prosecution. Applicant hereby makes a written conditional petition for extension of time, if required. Please charge any deficiencies in fees and credit any overpayment of fees to **Deposit Account No. 23-1951 (McGuireWoods)**.

Respectfully submitted,



Hae-Chan Park  
Reg. No.: 50,114

Dated: October 25, 2005

**McGuireWoods LLP**  
1750 Tysons Boulevard  
Suite 1800  
McLean, VA 22102-4215  
Tel: 703-712-5365  
Fax: 703-712-5280

HCP/JET/alj

\\COM\549236.1

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

**PATENT APPLICATION FEE DETERMINATION RECORD**

Substitute for Form PTO-875

Application or Patent Number

11138323

**APPLICATION AS FILED - PART I**

(Column 1)

(Column 2)

SMALL ENTITY

OR

OTHER THAN  
SMALL ENTITY

| FOR                                               | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))        | N/A                                                                                                                                                                                                                           | N/A          |
| SEARCH FEE<br>(37 CFR 1.16(k), (l), or (m))       | N/A                                                                                                                                                                                                                           | N/A          |
| EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))  | N/A                                                                                                                                                                                                                           | N/A          |
| TOTAL CLAIMS<br>(37 CFR 1.16(i))                  | 15                                                                                                                                                                                                                            | minus 20 =   |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))            | 4                                                                                                                                                                                                                             | minus 3 = 1  |
| APPLICATION SIZE<br>FEE<br>(37 CFR 1.16(s))       | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |              |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) |                                                                                                                                                                                                                               |              |

| RATE (\$) | FEE (\$) |
|-----------|----------|
| N/A       | 150      |
| N/A       |          |
| N/A       |          |
| x 25 =    |          |
| x 100 =   |          |
| N/A       |          |
| TOTAL     |          |

| RATE (\$) | FEE (\$) |
|-----------|----------|
| N/A       | 300      |
| N/A       |          |
| N/A       |          |
| x 50 =    |          |
| x 200 =   | 200      |
| N/A       |          |
| TOTAL     | 500      |

\* If the difference in column 1 is less than zero, enter "0" in column 2.

**APPLICATION AS AMENDED - PART II**

Pre-amend  
10-25-05

|                                                                 | (Column 1)                            | (Column 2)                         | (Column 3)    |
|-----------------------------------------------------------------|---------------------------------------|------------------------------------|---------------|
| AMENDMENT A                                                     | CLAIMS REMAINING AFTER AMENDMENT      | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA |
|                                                                 | Total<br>(37 CFR 1.16(i))             | 15                                 | Minus 20 =    |
|                                                                 | Independent<br>(37 CFR 1.16(h))       | 4                                  | Minus 4 =     |
|                                                                 | Application Size Fee (37 CFR 1.16(s)) |                                    |               |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                       |                                    |               |

| RATE (\$)       | ADDITIONAL FEE (\$) |
|-----------------|---------------------|
| x               |                     |
| x               |                     |
| N/A             |                     |
| TOTAL ADD'L FEE |                     |

| RATE (\$)       | ADDITIONAL FEE (\$) |
|-----------------|---------------------|
| x               |                     |
| x               |                     |
| N/A             |                     |
| TOTAL ADD'L FEE |                     |

|                                                                 | (Column 1)                            | (Column 2)                         | (Column 3)    |
|-----------------------------------------------------------------|---------------------------------------|------------------------------------|---------------|
| AMENDMENT B                                                     | CLAIMS REMAINING AFTER AMENDMENT      | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA |
|                                                                 | Total<br>(37 CFR 1.16(i))             |                                    | Minus ** =    |
|                                                                 | Independent<br>(37 CFR 1.16(h))       |                                    | Minus *** =   |
|                                                                 | Application Size Fee (37 CFR 1.16(s)) |                                    |               |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                       |                                    |               |

| RATE (\$)       | ADDITIONAL FEE (\$) |
|-----------------|---------------------|
| x               |                     |
| x               |                     |
| N/A             |                     |
| TOTAL ADD'L FEE |                     |

| RATE (\$)       | ADDITIONAL FEE (\$) |
|-----------------|---------------------|
| x               |                     |
| x               |                     |
| N/A             |                     |
| TOTAL ADD'L FEE |                     |

\* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

\*\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

| <b>MULTIPLE DEPENDENT CLAIM<br/>FEE CALCULATION SHEET</b><br>Substitute for Form PTO-1360<br>(For use with Form PTO/SB/06) |          |        |                       |        |                        |        | Application Number<br><div style="font-size: 1.5em; font-family: cursive;">11138323</div> |        | Filing Date |        |
|----------------------------------------------------------------------------------------------------------------------------|----------|--------|-----------------------|--------|------------------------|--------|-------------------------------------------------------------------------------------------|--------|-------------|--------|
|                                                                                                                            |          |        |                       |        |                        |        | Applicant(s)                                                                              |        |             |        |
| * May be used for additional claims or amendments                                                                          |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| CLAIMS                                                                                                                     | AS FILED |        | AFTER FIRST AMENDMENT |        | AFTER SECOND AMENDMENT |        |                                                                                           |        |             |        |
|                                                                                                                            | Indep    | Depend | Indep                 | Depend | Indep                  | Depend | Indep                                                                                     | Depend | Indep       | Depend |
| 1                                                                                                                          |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 2                                                                                                                          |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 3                                                                                                                          |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 4                                                                                                                          |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 5                                                                                                                          |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 6                                                                                                                          |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 7                                                                                                                          |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 8                                                                                                                          |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 9                                                                                                                          |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 10                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 11                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 12                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 13                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 14                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 15                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 16                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 17                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 18                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 19                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 20                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 21                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 22                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 23                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 24                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 25                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 26                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 27                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 28                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 29                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 30                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 31                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 32                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 33                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 34                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 35                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 36                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 37                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 38                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 39                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 40                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 41                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 42                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 43                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 44                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 45                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 46                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 47                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 48                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 49                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 50                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 51                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 52                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 53                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 54                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 55                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 56                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 57                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 58                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 59                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 60                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 61                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 62                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 63                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 64                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 65                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 66                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 67                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 68                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 69                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 70                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 71                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 72                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 73                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 74                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 75                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 76                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 77                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 78                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 79                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 80                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 81                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 82                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 83                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 84                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 85                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 86                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 87                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 88                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 89                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 90                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 91                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 92                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 93                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 94                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 95                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 96                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 97                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 98                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 99                                                                                                                         |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| 100                                                                                                                        |          |        |                       |        |                        |        |                                                                                           |        |             |        |
| Total Indep                                                                                                                | 4        |        |                       |        |                        |        |                                                                                           |        |             |        |
| Total Depend                                                                                                               | 11       |        |                       |        |                        |        |                                                                                           |        |             |        |
| Total Claims                                                                                                               | 15       |        |                       |        |                        |        |                                                                                           |        |             |        |

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



## UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
 United States Patent and Trademark Office  
 Address: COMMISSIONER FOR PATENTS  
 P.O. Box 1450  
 Alexandria, Virginia 22313-1450  
 www.uspto.gov

| APPLICATION NUMBER | FILING OR 371 (c) DATE | FIRST NAMED APPLICANT | ATTORNEY DOCKET NUMBER |
|--------------------|------------------------|-----------------------|------------------------|
| 11/138,323         | 05/27/2005             | Won-Kyu Kwak          | 6161.0533.US           |

CONFIRMATION NO. 9963

FORMALITIES  
 LETTER

23345  
 MCGUIREWOODS, LLP  
 1750 TYSONS BLVD  
 SUITE 1800  
 MCLEAN, VA 22102

Date Mailed: 09/07/2005

## NOTICE OF OMITTED ITEM(S) IN A NONPROVISIONAL APPLICATION

## FILED UNDER 37 CFR 1.53(b)

A filing date has been accorded to the above-identified nonprovisional application papers; however, the following item(s) appear to have been omitted from the application:

- Figure(s) 2F described in the specification.

I. Should applicant contend that the above-noted omitted item(s) was in fact deposited in the U.S. Patent and Trademark Office (USPTO) with the nonprovisional application papers, a copy of this Notice and a petition (and \$400.00 petition fee (37 CFR 1.17(f))) with evidence of such deposit **must** be filed within **TWO MONTHS** of the date of this Notice. The petition fee will be refunded if it is determined that the item(s) was received by the USPTO.

II. Should applicant desire to supply the omitted item(s) and accept the date that such omitted item(s) was filed in the USPTO as the filing date of the above-identified application, a copy of this Notice, the omitted item(s) (with a supplemental oath or declaration in compliance with 37 CFR 1.63 and 1.64 referring to such items), and a petition under 37 CFR 1.182 (with the \$400.00 petition fee (37 CFR 1.17(f))) requesting the later filing date **must** be filed within **TWO MONTHS** of the date of this Notice.

Applicant is advised that generally the filing fee required for an application is the filing fee in effect on the filing date accorded the application and that payment of the requisite basic filing fee on a date later than the filing date of the application requires payment of a surcharge (37 CFR 1.16(f)). To avoid processing delays and payment of a surcharge, applicant should submit any balance due for the requisite filing fee based on the later filing date being requested when submitting the omitted items(s) and the petition (and petition fee) requesting the later filing date.

III. The failure to file a petition (and petition fee) under the above options (I) or (II) within **TWO MONTHS** of the date of this Notice (37 CFR 1.181(f)) will be treated as a constructive acceptance by the applicant of the application as deposited in the USPTO. **THIS TWO MONTH PERIOD IS NOT EXTENDABLE UNDER 37 CFR 1.136(a) or (b).** In the absence of a timely filed petition in reply to this Notice, the application will maintain a filing date as of the date of deposit of the application papers in the USPTO, and original application papers (*i.e.*, the original disclosure of the invention) will include only those application papers present in the USPTO on the date of deposit.

In the event that applicant elects not to take action pursuant to options (I) or (II) above (thereby constructively electing option (III)), amendment of the specification to renumber the pages consecutively and cancel incomplete sentences caused by any omitted page(s), and/or amendment of the specification to cancel all references to any

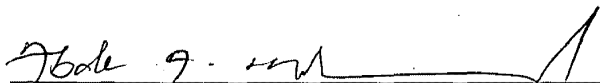
omitted drawing(s), relabel the drawing figures to be numbered consecutively (if necessary), and correct the references in the specification to the drawing figures to correspond with any relabeled drawing figures, is required. A copy of the drawing figures showing the proposed changes in red ink should accompany with any drawing changes. Such amendment and/or correction to the drawing figures, if necessary, should be by way of preliminary amendment submitted prior to the first Office action to avoid delays in the prosecution of the application.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Replies should be mailed to: Mail Stop Missing Parts  
Commissioner for Patents  
P.O. Box 1450  
Alexandria VA 22313-1450

---

*A copy of this notice **MUST** be returned with the reply.*



Office of Initial Patent Examination (571) 272-4000, or 1-800-PTO-9199, or 1-800-972-6382  
PART 3 - OFFICE COPY

|                                                                                                                       |                            |
|-----------------------------------------------------------------------------------------------------------------------|----------------------------|
| <b>Response To Notice To File Missing Parts Of Application</b><br><b>Filing Date Granted (PTO-1533)(Large Entity)</b> | Docket No.<br>6161.0533.US |
|-----------------------------------------------------------------------------------------------------------------------|----------------------------|

In Re Application Of: Wan-Kyu KWAK, et al.

|                               |                             |                            |                       |                        |                          |
|-------------------------------|-----------------------------|----------------------------|-----------------------|------------------------|--------------------------|
| Application No.<br>11/138,323 | Filing Date<br>May 27, 2005 | Examiner<br>To Be Assigned | Customer No.<br>23345 | Group Art Unit<br>2811 | Confirmation No.<br>9963 |
|-------------------------------|-----------------------------|----------------------------|-----------------------|------------------------|--------------------------|

Invention: ELECTROLUMINESCENCE DISPLAY DEVICE AND METHOD OF MANUFACTURING THE SAME

Mail Stop Missing Parts

COMMISSIONER FOR PATENTS:

This is a response to the Notice to File Missing Parts of Application - Filing Date Granted (PTO-1533) mailed on  
June 28, 2005  
Date

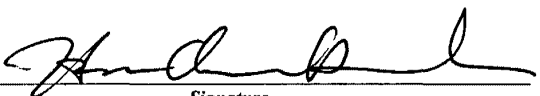
Enclosed herewith for filing are the following:

- ☒ A copy of the Notice to File Missing Parts of Application - Filing Date Granted (PTO-1533). **(REQUIRED)**
- ☐ An oath or declaration in compliance with 37 CFR 1.63, including residence information and identifying the application by the above Application Number and Filing Date.
- ☒ A properly signed oath or declaration in compliance with 37 CFR 1.63.
- ☐ An oath or declaration in compliance with 37 CFR 1.63 listing the names of all inventors and signed by the omitted inventor(s), identifying this application by the above Application Number and Filing Date.
- ☐ A verified English translation of the non-English language application papers as originally filed. It is requested that this translation be used as the copy for examination purposes in the United States Patent and Trademark Office.
- ☒ Other (list):

Statement Under 37 C.F.R. 3.73(b), POWER OF ATTORNEY BY ASSIGNEE

08/31/2005 JAD001 00000003 11138323  
02 F:1251 120.00 OP



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                    |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                   |                                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|---------------------------------|
| <b>Response To Notice To File Missing Parts Of Application</b><br><b>Filing Date Granted (PTO-1533) (Large Entity)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                    |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Docket No.<br><b>6161.0533.US</b> |                                 |
| In Re Application Of: <b>Wan-Kyu KWAK, et al.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                    |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                   |                                 |
| Application No.<br><b>11/138,323</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Filing Date<br><b>May 27, 2005</b> | Examiner<br><b>To Be Assigned</b> | Customer No.<br><b>23345</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Group Art Unit<br><b>2811</b>     | Confirmation No.<br><b>9963</b> |
| Invention: <b>ELECTROLUMINESCENCE DISPLAY DEVICE AND METHOD OF MANUFACTURING THE SAME</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                    |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                   |                                 |
| <u>TO THE COMMISSIONER FOR PATENTS:</u><br><u>Mail Stop Missing Parts</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                    |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                   |                                 |
| <p>The fee of <b>\$250.00</b> is to be paid as follows:</p> <p><input checked="" type="checkbox"/> A check in the amount of the fee is enclosed.</p> <p><input checked="" type="checkbox"/> The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account No. <b>23-1951</b></p> <p><input checked="" type="checkbox"/> If an additional extension of time is required, please consider this a petition therefor and charge any additional fees which may be required to Deposit Account No.</p> <p><input type="checkbox"/> Payment by credit card. Form PTO-2038 is attached.</p> <p><b>WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.</b></p> |                                    |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                   |                                 |
| <br>Signature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                    |                                   | Dated: <b>August 30, 2005</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                   |                                 |
| <b>Hae-Chan Park, Reg. No. 50,114</b><br><b>McGuireWoods, LLP</b><br><b>1750 Tysons Boulevard, Suite 1800</b><br><b>McLean, VA 22102</b><br><b>Telephone No.: 703-712-5365</b><br><b>Facsimile No.: 703-712-5280</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                    |                                   | <div style="border: 1px solid black; padding: 5px;"> I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)] on </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> (Date) </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> Signature of Person Mailing Correspondence </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> Typed or Printed Name of Person Mailing Correspondence </div> |                                   |                                 |
| CC:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                    |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                   |                                 |



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
 United States Patent and Trademark Office  
 Address: COMMISSIONER FOR PATENTS  
 P.O. Box 1450  
 Alexandria, Virginia 22313-1450  
 www.uspto.gov

| APPLICATION NUMBER | FILING OR 371 (c) DATE | FIRST NAMED APPLICANT | ATTORNEY DOCKET NUMBER |
|--------------------|------------------------|-----------------------|------------------------|
| 11/138,323         | 05/27/2005             | Won-Kyu Kwak          | 6161.0533.US           |

CONFIRMATION NO. 9963

## FORMALITIES LETTER



\*OC000000016400750\*

23345  
 MCGUIREWOODS, LLP  
 1750 TYSONS BLVD  
 SUITE 1800  
 MCLEAN, VA 22102

Date Mailed: 06/28/2005

## NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

*Filing Date Granted*Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The oath or declaration is unsigned.
- To avoid abandonment, a late filing fee or oath or declaration surcharge as set forth in 37 CFR 1.16(f) of \$130 for a non-small entity, must be submitted with the missing items identified in this letter.

The application is informal since it does not comply with the regulations for the reason(s) indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121(d) are required. The drawings submitted are not acceptable because:
  - The drawings must be reasonably free from erasures and must be free from alterations, overwriting, interlineations, folds, and copy marks. See Figure(s) All figures.

The following item(s) appear to have been **omitted** from the application:

- Figure(s) **2F** described in the specification.

I. Should applicant contend that the above-noted omitted item(s) was in fact deposited in the U.S. Patent and Trademark Office (USPTO) with the nonprovisional application papers, a copy of this Notice and a petition (and \$400.00 petition fee (37 CFR 1.17(f))) with evidence of such deposit **must** be filed within **TWO MONTHS** of the date of this Notice. The petition fee will be refunded if it is determined that the item(s) was received by the USPTO.

08/31/2005 JRD/DOL

00000003 11138323

01 FC:1051

130.00 OP

II. Should applicant desire to supply the omitted item(s) and accept the date that such omitted item(s) was filed in the USPTO as the filing date of the above-identified application, a copy of this Notice, the omitted item(s) (with a supplemental oath or declaration in compliance with 37 CFR 1.63 and 1.64 referring to such items), and a petition under 37 CFR 1.182 (with the \$400.00 petition fee (37 CFR 1.17(f)) requesting the later filing date **must** be filed within **TWO MONTHS** of the date of this Notice.

Applicant is advised that generally the filing fee required for an application is the filing fee in effect on the filing date accorded the application and that payment of the requisite basic filing fee on a date later than the filing date of the application requires payment of a surcharge (37 CFR 1.16(f)). To avoid processing delays and payment of a surcharge, applicant should submit any balance due for the requisite filing fee based on the later filing date being requested when submitting the omitted items(s) and the petition (and petition fee) requesting the later filing date.

III. The failure to file a petition (and petition fee) under the above options (I) or (II) within **TWO MONTHS** of the date of this Notice (37 CFR 1.181(f)) will be treated as a constructive acceptance by the applicant of the application as deposited in the USPTO. **THIS TWO MONTH PERIOD IS NOT EXTENDABLE UNDER 37 CFR 1.136(a) or (b).** In the absence of a timely filed petition in reply to this Notice, the application will maintain a filing date as of the date of deposit of the application papers in the USPTO, and original application papers (*i.e.*, the original disclosure of the invention) will include only those application papers present in the USPTO on the date of deposit.

In the event that applicant elects not to take action pursuant to options (I) or (II) above (thereby constructively electing option (III)), amendment of the specification to renumber the pages consecutively and cancel incomplete sentences caused by any omitted page(s), and/or amendment of the specification to cancel all references to any omitted drawing(s), relabel the drawing figures to be numbered consecutively (if necessary), and correct the references in the specification to the drawing figures to correspond with any relabeled drawing figures, is required. A copy of the drawing figures showing the proposed changes in red ink should accompany with any drawing changes. Such amendment and/or correction to the drawing figures, if necessary, should be by way of preliminary amendment submitted prior to the first Office action to avoid delays in the prosecution of the application.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

#### **SUMMARY OF FEES DUE:**

Total additional fee(s) required for this application is **\$130** for a Large Entity

- **\$130** Late oath or declaration Surcharge.

Replies should be mailed to: Mail Stop Missing Parts  
Commissioner for Patents  
P.O. Box 1450  
Alexandria VA 22313-1450

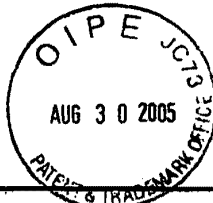
---

*A copy of this notice **MUST** be returned with the reply.*



Office of Initial Patent Examination (703) 308-1202

PART 2 - COPY TO BE RETURNED WITH RESPONSE



|                                                                                                                                                                |  |                          |                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------|---------------------|
| <b>DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION</b>                                                                                                    |  | Docket No.:              | 6161.0533.US        |
| <input checked="" type="checkbox"/> Declaration -or- <input type="checkbox"/> Declaration<br>Submitted with initial filing      submitted after initial filing |  | First Named Inventor:    | Won-Kyu Kwak et al. |
|                                                                                                                                                                |  | <i>Complete if known</i> |                     |
|                                                                                                                                                                |  | Application No:          | 11/138,323          |
|                                                                                                                                                                |  | Application Filing Date: | 27 May 2005         |
|                                                                                                                                                                |  | Group Art Unit:          | Unassigned          |
|                                                                                                                                                                |  | Examiner Name:           | Unassigned          |

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**ELECTROLUMINESCENCE DISPLAY DEVICE AND METHOD OF MANUFACTURING THE SAME**

The specification of which:

(check one)      is attached hereto  
☒ was filed on 27 May 2005  
                          as Application Serial No. 11/138,323  
                          and was amended on \_\_\_\_\_  
                          (if applicable)

#### ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56.

#### 37, Code of Federal Regulations, § 1.56

- (a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith toward the Patent and Trademark Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned.
- (b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and (1) it establishes, by itself or in combination with other information, a prima facie case of unpatentability; or (2) it refutes, or is inconsistent with, a position the applicant takes in: (i) opposing an argument of unpatentability relied on by the Office, or (ii) asserting an argument of patentability.

McGUIREWOODS

Page 1 of 3

**PRIORITY CLAIMS****Foreign and Provisional Applications**

| Prior Application Number(s) | Country or Provisional | Filing Date (MM/DD/YYYY) | Priority Not Claimed     |
|-----------------------------|------------------------|--------------------------|--------------------------|
| 10-2004-0038735             | KOREA                  | 29 May 2004              | <input type="checkbox"/> |

**U.S. and PCT Applications**

| <p>I hereby claim the benefit under Title 35, United States Code § 120 of any United States application(s), or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of the Federal Regulations § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.</p> |                   |                                 |                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------------------|--------------------------------------|
| U.S. Parent Application Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | PCT Parent Number | Parent Filing Date (MM/DD/YYYY) | Parent Patent Number (if applicable) |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |                                 |                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |                                 |                                      |
| <input type="checkbox"/> Additional U.S. and/or PCT international application numbers are listed on a supplemental priority sheet attached hereto.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                                 |                                      |

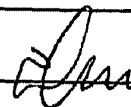
# DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of Sole

or First Inventor Won-Kyu Kwak

Inventor's Signature



Date 25 August 2005

Residence c/o Samsung SDI Co., Ltd., 575 Shin-dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Republic of Korea

Citizenship Republic of Korea

Post Office Address Same as above

Full Name of Sole

or Second Inventor Kwan-Hee Lee

Inventor's Signature



Date 25 August 2005

Residence c/o Samsung SDI Co., Ltd., 575 Shin-dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Republic of Korea

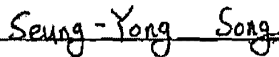
Citizenship Republic of Korea

Post Office Address Same as above

Full Name of Sole

or Second Inventor Seung-Yong Song

Inventor's Signature



Date 25 August 2005

Residence c/o Samsung SDI Co., Ltd., 575 Shin-dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Republic of Korea

Citizenship Republic of Korea

Post Office Address Same as above

**Revised Power of Attorney Practice - 37 CFR 1.32**  
**(Applies to powers of attorney filed on or after June 25, 2004)**

As a result of a revision of the patent rules relating to powers of attorney, a power of attorney filed on or after June 25, 2004 must either appoint:

- a) One or more joint inventors; OR
- ~~b) Those registered practitioners associated with a Customer Number; OR~~
- c) Ten or fewer patent practitioners, either in the power of attorney itself, or by a listing in a separate paper accompanying the power of attorney, as explained below.

See (newly established) 37 CFR 1.32(b) and (c), the text of which is as follows:

- (b) A power of attorney must:
  - (1) Be in writing;
  - (2) Name one or more representatives in compliance with (c) of this section;
  - (3) Give the representative power to act on behalf of the principal; and
  - (4) Be signed by the applicant for patent (§ 1.41(b)) or the assignee of the entire interest of the applicant.
- (c) A power of attorney may only name as representative:
  - (1) One or more joint inventors (§ 1.45);
  - (2) Those registered patent practitioners associated with a Customer Number;
  - (3) Ten or fewer registered patent attorneys or registered patent agents (see § 10.6 of this subchapter) (patent practitioners). Except as provided in paragraph (c)(1) or (c)(2) of this section, the Office will not recognize more than ten patent practitioners as being of record in an application or patent. If a power of attorney names more than ten patent practitioners, such power of attorney must be accompanied by a separate paper indicating which ten patent practitioners named in the power of attorney are to be recognized by the Office as being of record in application or patent to which the power of attorney is directed.

The filing receipt reflects the power of attorney that has been entered for the application. If the power of attorney appointed more than ten patent practitioners, without reference to a Customer Number and without a separate paper indicating which ten patent practitioners named in the power of attorney are to be recognized, then no patent practitioner has been made of record.

How to take corrective action: Resubmit a copy of the power of attorney along with a separate paper indicating which (up to ten) patent practitioners named in the power of attorney are to be recognized by the Office as being of record in the application or patent to which the power of attorney is directed, or file a newly executed power of attorney in compliance with 37 CFR 1.32.

After receipt of such a submission, the patent practitioners listed on the separate paper or new power of attorney in compliance with 37 CFR 1.32 will be recognized as being of record. For additional information regarding this change in practice, see Revision of Power of Attorney and Assignment Practice, 69 Fed. Reg. 29865 (May 26, 2004); 1283 Off. Gaz. 148 (Jun. 22, 2004) and <http://www.uspto.gov/web/offices/pac/dapp/poafaqs.htm>.

August 11, 2004

BEST AVAILABLE COPY



**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

|                       |                     |   |                     |
|-----------------------|---------------------|---|---------------------|
| In re Application of: | Won-Kyu Kwak et al. | ) |                     |
|                       |                     | ) |                     |
| Application No.:      | 11/138,323          | ) | Group Art Unit: TBD |
|                       |                     | ) |                     |
| Filed:                | 27 May 2005         | ) | Examiner: TBD       |
|                       |                     | ) |                     |

For: **ELECTROLUMINESCENCE DISPLAY DEVICE AND METHOD OF  
MANUFACTURING THE SAME**

**Commissioner for Patents**  
**P.O. Box 1450**  
**Alexandria, VA 22313-1450**

**STATEMENT UNDER 37 C.F.R. § 3.73(b), POWER OF ATTORNEY BY ASSIGNEE**

Samsung SDI Co., Ltd., a Korean corporation, states that it is the assignee of the entire right, title, and interest in the above-mentioned patent applications by virtue of assignments from their respective inventor(s). A copy of the Assignment document is attached.

The assignee of the above-identified patent application hereby appoints the registered practitioners of McGuireWoods LLP included in the following customer number to prosecute the above application and transact all business in the U.S. Patent and Trademark Office connected therewith, and directs that all correspondence be addressed to that Customer Number:

**CUSTOMER NUMBER: 23345**

**Address correspondence to:**

**McGuireWoods LLP**  
**1750 Tysons Boulevard**  
**Suite 1800**  
**McLean, VA 22102**

Docket No.: 6161.0533.US

Direct Telephone Calls to Hae-Chan Park, Esq. at 703-712-5365.

On behalf of Samsung SDI Co., Ltd.:

FOR: Samsung SDI Co., Ltd.

SIGNATURE: Sam Ju Choi

BY: Sam Ju CHOI

TITLE: staff

DATE: 25 August 2005



## UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
 United States Patent and Trademark Office  
 Address: COMMISSIONER FOR PATENTS  
 P.O. Box 1450  
 Alexandria, Virginia 22313-1450  
 www.uspto.gov

| APPLICATION NUMBER | FILING OR 371 (c) DATE | FIRST NAMED APPLICANT | ATTORNEY DOCKET NUMBER |
|--------------------|------------------------|-----------------------|------------------------|
| 11/138,323         | 05/27/2005             | Won-Kyu Kwak          | 6161.0533.US           |

23345  
 MCGUIREWOODS, LLP  
 1750 TYSONS BLVD  
 SUITE 1800  
 MCLEAN, VA 22102

CONFIRMATION NO. 9963

## FORMALITIES LETTER



\*OC000000016400750\*

Date Mailed: 06/28/2005

## NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

*Filing Date Granted***Items Required To Avoid Abandonment:**

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The oath or declaration is unsigned.
- To avoid abandonment, a late filing fee or oath or declaration surcharge as set forth in 37 CFR 1.16(f) of \$130 for a non-small entity, must be submitted with the missing items identified in this letter.

The application is informal since it does not comply with the regulations for the reason(s) indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121(d) are required. The drawings submitted are not acceptable because:
  - The drawings must be reasonably free from erasures and must be free from alterations, overwriting, interlineations, folds, and copy marks. See Figure(s) All figures.

The following item(s) appear to have been **omitted** from the application:

- Figure(s) 2F described in the specification.

I. Should applicant contend that the above-noted omitted item(s) was in fact deposited in the U.S. Patent and Trademark Office (USPTO) with the nonprovisional application papers, a copy of this Notice and a petition (and \$400.00 petition fee (37 CFR 1.17(f))) with evidence of such deposit **must** be filed within **TWO MONTHS** of the date of this Notice. The petition fee will be refunded if it is determined that the item(s) was received by the USPTO.

II. Should applicant desire to supply the omitted item(s) and accept the date that such omitted item(s) was filed in the USPTO as the filing date of the above-identified application, a copy of this Notice, the omitted item(s) (with a supplemental oath or declaration in compliance with 37 CFR 1.63 and 1.64 referring to such items), and a petition under 37 CFR 1.182 (with the \$400.00 petition fee (37 CFR 1.17(f)) requesting the later filing date **must** be filed within **TWO MONTHS** of the date of this Notice.

Applicant is advised that generally the filing fee required for an application is the filing fee in effect on the filing date accorded the application and that payment of the requisite basic filing fee on a date later than the filing date of the application requires payment of a surcharge (37 CFR 1.16(f)). To avoid processing delays and payment of a surcharge, applicant should submit any balance due for the requisite filing fee based on the later filing date being requested when submitting the omitted items(s) and the petition (and petition fee) requesting the later filing date.

III. The failure to file a petition (and petition fee) under the above options (I) or (II) within **TWO MONTHS** of the date of this Notice (37 CFR 1.181(f)) will be treated as a constructive acceptance by the applicant of the application as deposited in the USPTO. **THIS TWO MONTH PERIOD IS NOT EXTENDABLE UNDER 37 CFR 1.136(a) or (b).** In the absence of a timely filed petition in reply to this Notice, the application will maintain a filing date as of the date of deposit of the application papers in the USPTO, and original application papers (i.e., the original disclosure of the invention) will include only those application papers present in the USPTO on the date of deposit.

In the event that applicant elects not to take action pursuant to options (I) or (II) above (thereby constructively electing option (III)), amendment of the specification to renumber the pages consecutively and cancel incomplete sentences caused by any omitted page(s), and/or amendment of the specification to cancel all references to any omitted drawing(s), relabel the drawing figures to be numbered consecutively (if necessary), and correct the references in the specification to the drawing figures to correspond with any relabeled drawing figures, is required. A copy of the drawing figures showing the proposed changes in red ink should accompany with any drawing changes. Such amendment and/or correction to the drawing figures, if necessary, should be by way of preliminary amendment submitted prior to the first Office action to avoid delays in the prosecution of the application.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

#### **SUMMARY OF FEES DUE:**

Total additional fee(s) required for this application is **\$130** for a Large Entity

- **\$130** Late oath or declaration Surcharge.

Replies should be mailed to: Mail Stop Missing Parts  
Commissioner for Patents  
P.O. Box 1450  
Alexandria VA 22313-1450

---

*A copy of this notice **MUST** be returned with the reply.*

  
Office of Initial Patent Examination (703) 308-1202

PART 3 - OFFICE COPY

052705

1698 U.S. PTO

**UTILITY PATENT APPLICATION TRANSMITTAL  
(Large Entity)***(Only for new nonprovisional applications under 37 CFR 1.53(b))*Docket No.  
6161.0533.US

Total Pages in this Submission

**COMMISSIONER FOR PATENTS**P.O. Box 1450  
Alexandria, VA 22313-1450

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

**ELECTROLUMINESCENCE DISPLAY DEVICE AND METHOD OF MANUFACTURING THE SAME**

and invented by:

**Won-Kyu KWAK; Kwan-Hee LEE; Seung-Yong SONG**112948 U.S. PTO  
11/138323  
052705If a **CONTINUATION APPLICATION**, check appropriate box and supply the requisite information:☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: \_\_\_\_\_

Which is a:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: \_\_\_\_\_

Which is a:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: \_\_\_\_\_

Enclosed are:

**Application Elements**

1. ☒ Filing fee as calculated and transmitted as described below
2. ☒ Specification having 21 pages and including the following:
  - a. ☒ Descriptive Title of the Invention
  - b. ☒ Cross References to Related Applications *(if applicable)*
  - c. ☐ Statement Regarding Federally-sponsored Research/Development *(if applicable)*
  - d. ☐ Reference to Sequence Listing, a Table, or a Computer Program Listing Appendix
  - e. ☒ Background of the Invention
  - f. ☒ Brief Summary of the Invention
  - g. ☒ Brief Description of the Drawings *(if filed)*
  - h. ☒ Detailed Description
  - i. ☒ Claim(s) as Classified Below
  - j. ☒ Abstract of the Disclosure

**UTILITY PATENT APPLICATION TRANSMITTAL**  
**(Large Entity)**

*(Only for new nonprovisional applications under 37 CFR 1.53(b))*

Docket No.  
6161.0533.US

Total Pages in this Submission

**Application Elements (Continued)**

3. ☒ Drawing(s) *(when necessary as prescribed by 35 USC 113)*
- a. ☒ Formal Number of Sheets 10
- b. ☐ Informal Number of Sheets \_\_\_\_\_
4. ☒ Oath or Declaration
- a. ☐ Newly executed *(original or copy)* ☒ Unexecuted
- b. ☐ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*
- c. ☐ With Power of Attorney ☐ Without Power of Attorney
- d. ☐ DELETION OF INVENTOR(S)  
Signed statement attached deleting inventor(s) named in the prior application,  
see 37 C.F.R. 1.63(d)(2) and 1.33(b).
5. ☐ Incorporation By Reference *(usable if Box 4b is checked)*  
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under  
Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby  
incorporated by reference therein.
6. ☐ CD ROM or CD-R in duplicate, large table or Computer Program (Appendix)
7. ☐ Application Data Sheet (See 37 CFR 1.76)
8. ☐ Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all must be included)*
- a. ☐ Computer Readable Form (CRF)
- b. ☐ Specification Sequence Listing on:
- i. ☐ CD-ROM or CD-R (2 copies); or
- ii. ☐ Paper
- c. ☐ Statement(s) Verifying Identical Paper and Computer Readable Copy

**Accompanying Application Parts**

9. ☐ Assignment Papers *(cover sheet & document(s))*
10. ☐ 37 CFR 3.73(B) Statement *(when there is an assignee)*
11. ☐ English Translation Document *(if applicable)*
12. ☐ Information Disclosure Statement/PTO-1449 ☐ Copies of IDS Citations
13. ☐ Preliminary Amendment
14. ☒ Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
15. ☒ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
16. ☐ Certificate of Mailing
- ☐ First Class ☐ Express Mail *(Specify Label No.):* hand carry

*(Only for new nonprovisional applications under 37 CFR 1.53(b))*

Total Pages in this Submission

17. ☐ Additional Enclosures (please identify below):

|  |
|--|
|  |
|--|

18. ☐ Pursuant to 35 U.S.C. 122(b)(2), Applicant hereby requests that this patent application not be published pursuant to 35 U.S.C. 122(b)(1). Applicant hereby certifies that the invention disclosed in this application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication of applications 18 months after filing of the application.

***An applicant who makes a request not to publish, but who subsequently files in a foreign country or under a multilateral international agreement specified in 35 U.S.C. 122(b)(2)(B)(i), must notify the Director of such filing not later than 45 days after the date of the filing of such foreign or international application. A failure of the applicant to provide such notice within the prescribed period shall result in the application being regarded as abandoned, unless it is shown to the satisfaction of the Director that the delay in submitting the notice was unintentional.***

16698 U.S. PTO  
052705

**UTILITY PATENT APPLICATION TRANSMITTAL**  
**(Large Entity)**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.  
6161.0533.US

Total Pages in this Submission

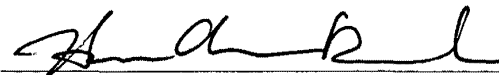
**Fee Calculation and Transmittal**

| CLAIMS AS FILED                                                          |        |                      |                           |      |          |            |
|--------------------------------------------------------------------------|--------|----------------------|---------------------------|------|----------|------------|
| For                                                                      | #Filed | #Allowed             | #Extra                    | Rate |          | Fee        |
| Total Claims                                                             | 15     | - 20 =               | 0                         | x    | \$50.00  | \$0.00     |
| Indep. Claims                                                            | 4      | - 3 =                | 1                         | x    | \$200.00 | \$200.00   |
| Multiple Dependent Claims (check if applicable) <input type="checkbox"/> |        |                      |                           |      |          | \$0.00     |
| Total # of Pages in Specification                                        |        | 21                   | Total # of Drawing Sheets |      | 10       |            |
| Total # of Sheets                                                        | 31     | Application Size Fee |                           |      |          | \$0.00     |
| Basic Fee                                                                |        |                      |                           |      |          | \$300.00   |
| Search Fee                                                               |        |                      |                           |      |          | \$500.00   |
| Examination Fee                                                          |        |                      |                           |      |          | \$200.00   |
| OTHER FEE (specify purpose)                                              |        |                      |                           |      |          | \$0.00     |
| TOTAL FILING FEE                                                         |        |                      |                           |      |          | \$1,200.00 |

- ☒ A check in the amount of \$1,200.00 to cover the filing fee is enclosed.
- ☒ The Director is hereby authorized to charge and credit Deposit Account No. 23-1951 as described below.
- ☐ Charge the amount of \_\_\_\_\_ as filing fee.
- ☒ Credit any overpayment.
- ☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
- ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

☐ Payment by credit card. Form PTO-2038 is attached.

**WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.**



Signature

Dated: 27 May 2005

Customer Number: 23345

cc: HCP:PCF/tmf

Hae-Chan Park  
Registration No. 50,114  
McGuireWoods LLP  
1750 Tysons Boulevard, Suite 1800  
McLean, Virginia 22102  
Telephone: 703-712-5365  
Facsimile: 703-712-5280

# **ELECTROLUMINESCENCE DISPLAY DEVICE AND METHOD OF MANUFACTURING THE SAME**

## **BACKGROUND OF THE INVENTION**

[0001] This application claims the priority of Korean Patent Application No. 10-2004-  
5 0038735, filed May 29, 2004, which is incorporated herein in its entirety by reference.

### **1. Field of the Invention**

[0002] The present invention relates, for example, to a flat panel display. More  
particularly it relates, for example, to an organic or inorganic electroluminescence display device  
that can avoid peeling and other damage in the process of fabricating the electroluminescence  
10 device.

### **2. Description of the Related Art**

[0003] Many kinds of display apparatuses are used to display images. Recently, various  
flat panel display devices have begun to substitute for cathode ray tubes (CRT). Flat panel  
display devices are either emissive or non-emissive. The emissive type display devices include,  
15 for example, a flat CRT, a plasma display panel (PDP), a vacuum fluorescent display, a field  
emission display (FED), and an inorganic or organic electroluminescent (EL) display.  
Non-emissive type display devices include, for example, liquid crystal displays (LCD). An  
organic EL device is, for example, an emissive device that does not require an additional light  
emitting unit such as a backlight. Thus, an organic EL device can operate with high efficiency  
20 and low power consumption and can emit blue light.

[0004] An organic EL device is an emissive display device in which electrons and holes  
injected through an anode and a cathode are recombined in an organic thin film to form excitons.

Light of a certain wavelength is generated by the energy of the excitons. An organic EL device can be driven with low voltage, can be thin with light weight, can have a wide viewing angle, and can have a fast response speed.

[0005] An organic EL unit of an organic EL device includes a first electrode formed on a substrate (that can serve as an anode), an organic light emitting unit, and a second electrode (that can serve as a cathode). The organic light emitting unit includes an organic emitting layer (EML). Electrons and holes recombine in the organic EML to form excitons and generate light. In order to improve light emitting efficiency, the electrons and holes should be transported appropriately to the organic EML. Thus, an electron transport layer (ETL) can be disposed between the cathode and the organic EML and a hole transport layer (HTL) can be disposed between the anode and the organic EML. In addition, a hole injection layer (HIL) can be disposed between the anode and the HTL and an electron injection layer (EIL) can be disposed between the cathode and the ETL.

[0006] An organic EL device can be either a passive matrix (PM) type device or an active matrix (AM) type device, depending on how it is driven. In a PM type organic EL device, each anode and cathode pair is arranged in a column and row. A scan signal is, for example, supplied to the cathode from a row driving circuit, and one row is selected from among the rows. In addition, data signals are input into respective pixels in a column driving circuit. The AM type EL device controls the signal input into each pixel using a thin film transistor (TFT), and is suitable for processing enormous amounts of signals. Therefore, the AM type organic EL device is widely used as a display for realizing moving pictures.

[0007] As resolution of images displayed on the display device increases and the display device becomes larger, there is a need to reduce power consumption and improve aspects of

image quality such as brightness. One of the methods is to reduce resistances of various wires through which power is supplied to the display area. Examples of such wires include the driving power supply line and the electrode power supply line.

[0008] Japanese Laid-open Patent No. 2001-109395 discloses an organic EL device,  
5 having an electrode that is electrically contacted to a cathode through a wide contacting portion between a terminal and a cathode and is formed of the same oxide material as an anode. The contact resistance that is caused by directly contacting the cathode to the terminal can be reduced, and the image quality can be improved.

[0009] However, according to the above conventional art, most of an insulating layer on  
10 an upper portion of the terminal is removed and the terminal is excessively exposed. Thus, the layer constituting the terminal may be peeled or damaged seriously in a subsequent process. In addition, an over coat layer that is made of an acryl-based resin is disposed on a lower portion of the electrode formed of the same oxide material as the anode, and the discharge path of gas generated from the over coat layer is blocked or lengthened by the electrode. Thus, the gas  
15 cannot discharge well, defects may occur, and time for processing may increase.

### **SUMMARY OF THE INVENTION**

[0010] The present invention provides, for example, an electroluminescence (EL) display with a structure for preventing an electrode power supply line from being damaged and/or peeled. The structure may also help to sufficiently discharge gas generated from an  
20 insulating layer including an organic material layer. The present invention also provides, for example, a method of manufacturing such an EL display.

[0011] The present invention provides, for example, an EL display device that can include a display area with pixels. Each pixel can include a first electrode layer (this layer can

include one or more layers) and a second electrode layer on a substrate. Electroluminescence units can be formed between the first and second electrode layers. An electrode power supply line can supply electrode power to the display area. One or more insulating layers can be disposed on the electrode power supply line and can include one or more via holes. The  
5 insulating layer can include an organic material.

**[0012]** A sub-conductive layer can be formed on the insulating layer (including the via hole) along the electrode power supply line. The electrode power supply line and the second electrode layer can be coupled to each other at the via hole through the sub-conductive layer. The sub-conductive layer on the insulating layer can include one or more penetration portions.

10 **[0013]** The present invention may also provide an electroluminescence display device including a display area including pixels (each of which may include a first electrode layer and a second electrode layer on a substrate), and electroluminescence units formed between the first and second electrode layers. It may also include an electrode power supply line supplying electrode power to the display area, an insulating layer disposed on the electrode power supply  
15 line (including a via hole and having an organic material included), and a sub-conductive layer including one or more unit sub-conductive layers formed on the insulating layer along the electrode power supply line. The electrode power supply line and the second electrode layer are coupled to each other at the via hole through the sub-conductive layer. The unit sub-conductive layers on the insulating layer are separated from each other.

20 **[0014]** The present invention also provides, for example, a method of manufacturing an electroluminescence display device. The display device may include a display area including pixels (each of which includes a first electrode layer and a second electrode layer on a substrate) and electroluminescence units formed between the first and second electrode layers. The device

may also include an electrode power supply line supplying electrode power to the display area. The method may include the following: forming an insulating layer including an organic material on the electrode power supply line; forming a via hole on the insulating layer; forming a sub-conductive layer on the insulating layer; and forming a penetration portion on the sub-conductive layer.

[0015] The present invention additionally provides, for example, another method of manufacturing an electroluminescence display device. In the display device, a display area may include pixels (each of which includes a first electrode layer and a second electrode layer on a substrate), electroluminescence units formed between the first and second electrode layers, and an electrode power supply line supplying electrode power to the display area. The method may include the following: forming an insulating layer (including an organic material) on the electrode power supply line; forming a via hole on the insulating layer; and forming a sub-conductive layer including a plurality of unit sub-conductive layers on the insulating layer.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

[0016] FIG. 1 is a plan view showing an organic electroluminescence (EL) display of the present invention.

[0017] FIG. 2A is a partial cross-sectional view taken along line I-I of FIG. 1.

[0018] FIGS. 2B, 2C, 2D, 2E, and 2F are cross-sectional views showing processes of manufacturing the organic EL shown in FIG. 2A.

[0019] FIG. 3A is a partial cross-sectional view showing an organic EL of another embodiment of the present invention.

[0020] FIG. 3B is a partial cross-sectional view showing an organic EL of still another embodiment of the present invention.

[0021] FIGS. 4A and 4B are partial expanded views showing a sub-conductive layer of various shapes of the present invention.

[0022] FIG. 5 is a partial cross-sectional view showing an organic EL of still another embodiment of the present invention.

5 [0023] FIG. 6A is a partial expanded view showing a sub-conductive layer of the present invention.

[0024] FIG. 6B is a partial cross-sectional view showing an expanded portion of "B" in FIG. 1.

#### **DETAILED DESCRIPTION OF THE INVENTION**

10 [0025] The present invention will now be described in detail with reference to the accompanying drawings in which example embodiments of the invention are shown. The invention may, however, be embodied in different forms and should not be construed as limited to the embodiments shown and described. The dimensions in the drawings are exaggerated for clarity. The same reference numerals are used to denote the same elements throughout the  
15 specification.

[0026] FIG. 1 is a plan view showing an example organic electroluminescence (EL) device of the present invention. On a surface of a substrate 110, a display area 200 (from which a light emitting device such as an organic EL device can display), a sealing portion 800 applied along an outer portion of the display area 200 to seal the substrate 110 with a sealing substrate  
20 900 (refer to FIG. 2A), and a terminal area 700 (on which various terminals may be disposed), can be formed. The substrate 110 and sealing substrate 900 are sealed through a sealant 810 of the sealing portion 800. The display area 200 can be sealed using a thin film sealing layer without the sealing portion 800.

[0027] A structure of the organic EL device forming the display area 200 will be described with reference to FIG. 2A, which is a cross-sectional view taken along line I-I of FIG.

1. A buffer layer 120 of SiO<sub>2</sub> may be formed on the substrate 110 (which may be, for example, a glass substrate). A semiconductor active layer 130 may be formed on the buffer layer 120, and  
5 the semiconductor active layer 130 can be formed, for example, as an amorphous silicon layer or a polycrystalline silicon layer.

[0028] Although it is not shown in the drawing in detail, the semiconductor active layer 130 can include source and drain regions that are doped by N<sup>+</sup> type or P<sup>+</sup> type dopant, as well as a channel region. However, the semiconductor active layer 130 is not limited to the above  
10 description. For example, the semiconductor active layer 130 can be formed of an organic semiconductor.

[0029] A gate electrode 150 may be formed on a portion of the semiconductor active layer 130 that corresponds to the channel region. The conduction state of the channel region can be determined by the signal applied to the channel region. The source and drain regions may be  
15 placed in communication with each other through the selection of the gate electrode 150. It may be desirable that the gate electrode 150 be formed of a material (for example, MoW and Al/Cu). The following are some considerations for material selection for the gate electrode 150: its adhesiveness with neighboring layers, its surface evenness, and its ability to be fabricated.

[0030] In order to ensure the insulation between the semiconductor active layer 130 and  
20 the gate electrode 150, a gate insulating layer 140 formed of SiO<sub>2</sub> may be disposed between the semiconductor active layer 130 and the gate electrode 150. The gate insulating layer 140 may be deposited by plasma enhanced chemical vapor deposition (PECVD).

[0031] An interlayer 160 may be formed on the gate electrode 150. The interlayer 160

can be formed as a single layer or a dual-layered structure using SiO<sub>2</sub> or SiN<sub>x</sub>. A source/drain electrode 170 (it may serve as either the source electrode or the drain electrode) may be formed on the interlayer 160. The source/drain electrode 170 may be coupled to the source region or the drain region of the semiconductor active layer 130 respectively through a contact hole formed on the interlayer 160 and the gate insulating layer 140.

[0032] One or more insulating layers (a passivation layer and/or an over coat layer) may be formed on the source/drain electrode 170 to protect and/or planarize the thin film transistor (TFT) on a lower portion thereof. The insulating layer 180 can include an organic insulating layer with an organic material such as benzocyclobutene (BCB) or acryl. The insulating layer 180 may be formed as a single layer and/or multiple-layer. In addition, the insulating layer 180 may includes an inorganic layer formed of an inorganic material such as SiO<sub>2</sub> or SiN<sub>x</sub>.

[0033] A first electrode layer 210 may be formed on a surface of the insulating layer 180. One end of the first electrode layer 210 may contact the drain electrode 170 through a via hole 181 that is formed on the insulating layer 180. The first electrode layer 210 can be formed of a transparent electrode such as indium tin oxide (ITO) for a rear surface emitting type. For a device that is a front surface emitting type, the first electrode layer 210 may be formed as a transparent electrode with a material such as ITO, and can include a reflective layer formed of Al, AlNd, or MgAg.

[0034] An organic EL unit 230 can be formed as a low molecular weight or polymer organic layer. If the organic EL unit 230 uses the low molecular weight organic layer, the organic EL unit 230 may include one or more of the following layers: a hole injection layer (HIL), hole transport layer (HTL), emission layer (EML), electron transport layer (ETL), or electron injection layer (EIL). In addition, the organic layer can be made of copper

phthalocyanine (CuPc), N,N-di(naphthalene-1-yl)-N,N'-diphenyl-bezidine (NPB), or tris-8-hydroxyquinoline aluminum (Alq3). The lower molecular weight organic layer may be formed by vapor deposition.

[0035] If the organic EL unit 230 uses a polymer organic layer, it can include an HTL  
5 and an EML. PEDOT can be used as the HTL, and poly-phenylenevinylene (PPV)-based or polyfluorene-based molecular organic material can be used as the EML. The layers can be formed by screen printing or inkjet printing.

[0036] A second electrode layer 400 may be deposited on entire upper surface of the organic EL unit 230 as a cathode. The second electrode layer 400 may be deposited in any  
10 suitable manner and can be formed of a material such as Al/Ca, ITO, Mg-Ag depending on the light emitting type of the display (whether top, bottom, or dual emitting). In addition, it can be formed as multiple layers and can further include alkaline fluoride (such as LiF) or alkaline earth metal fluoride. The first electrode layer 210 is described as the anode, and the second electrode layer 400 is described as the cathode for convenience' sake in this application, but the functions  
15 could be readily inverted.

[0037] As shown in FIG. 1, a driving power supply line 300 may be disposed on the outer portion of the display area 200 for supplying the driving power to the display area 200. The driving power supply line 300 may be coupled to a driving power supplying terminal 320 of the terminal area 700. The arrangement of the driving power supply line is not limited to the  
20 example shown in FIG. 1.

[0038] It may be desirable that the driving power supply line 300 be formed to surround the display area 200 in order to improve the uniformity of brightness by supplying the driving power evenly to the entire display area. The driving power supply line 300 may be connected to

a driving line 310, and the driving line 310 may be arranged to cross the display area 200 and may be coupled to the source electrode 170 (refer to FIG. 2B) that is disposed under the insulating layer 180.

[0039] In addition, vertical and horizontal driving circuit units 500 and 600 may be disposed on the outer portion of the display area 200, and the vertical/horizontal driving circuit units 500 and 600 may be coupled to respective vertical and horizontal driving terminals 520 and 620 of the terminal area 700. The vertical driving circuit unit 500 can be a scan driving circuit unit that applies scan signals to the display area 200, and the horizontal driving circuit unit 600 can be a data driving circuit unit that applies data signals to the display area 200. In addition, these can be realized as an outer integrated circuit (IC) or a chip on glass (COG).

[0040] As shown in FIG. 1, an electrode power supply line 410 that supplies electrode power to the display area 200 may be disposed along a part of the outer portion of the display area 200. The electrode power supply line 410 may be coupled to an electrode power supply terminal 420 of the terminal area 700.

[0041] FIG. 2A is a partial cross-sectional view showing the organic EL device taken along line I-I of FIG. 1. In FIG. 2A, one or more insulating layers 180 may extend on the upper portion of the electrode power supply line 410 disposed on the outer portion of the display area 200. A sub-conductive layer 411 may be further formed on the extended insulating layer 180.

[0042] FIGS. 2B, 2C, 2D, and 2E are cross-sectional views showing processes of manufacturing the organic EL device of the present invention. As shown in FIG. 2B, the electrode power supply line 410 can be formed simultaneously with the source/drain electrode 170 of the TFT. After the electrode power supply line 410 is formed, one or more insulating layers 180 including an organic layer may be formed on the electrode power supply line 410.

[0043] As shown in FIG. 2C, a via hole 182 for electrically connecting to the electrode power supply line 410 may be formed. The via hole 182 for the electrode power supply line 410 can be formed simultaneously with the via hole 181 for electrically connecting the first electrode layer 210 (refer to FIG. 2D) (which may be the pixel electrode) to the source/drain electrode 170.

5 [0044] As shown in FIG. 2D, after forming the via hole 182, the sub-conductive layer 411 may be formed on the surface of the insulating layer 180 including the via hole 182. The coupling between the second electrode layer 400 and the electrode power supply line 410 may be performed by the sub-conductive layer 411 that is disposed between them.

10 [0045] Since the insulating layer 180 extends between the electrode power supply line 410 and the sub-conductive layer 411 (except for the via hole 182), peeling of the electrode power supply line 410 can be prevented. The peeling can occur when the insulating layer 180 is not disposed between the electrode power supply line 410 and the sub-conductive layer 411. In addition, the sub-conductive layer 411 can prevent the exposed electrode power supply line 410 from being damaged during the formation of a pixel defining layer (220, refer to FIG. 2E) and an  
15 organic EL unit 230 on the display area.

[0046] The sub-conductive layer 411 can be formed simultaneously with the first electrode layer 210. For example, if the organic EL device is a front surface emitting type including the reflective layer with a reflective material such as Al, AlNd, and MgAg, the sub-conductive layer 411 can include the transparent conductive layer such as ITO layer and/or  
20 the reflective layer AlNd. If the first electrode layer 210 is formed by depositing the material for the first electrode layer 210 on the insulating layer 180 including the via holes 181 and 182 and patterning the material, a portion of the material corresponding to the sub-conductive layer 411 can be patterned at the same time to form the sub-conductive layer 411.

[0047] One or more penetration portions 412 may be formed on the sub-conductive layer 411 that is on the insulating layer 180. As shown in FIG. 2D, after forming the penetration portion 412 on the sub-conductive layer 411, the stacked portions on the substrate undergo an annealing process under a vacuum environment for a predetermined period. This annealing can serve to discharge the gas such as benzaldehyde, benzyl alcohol, benzene-based compounds that can be generated from the insulating layer 180 containing an organic layer. Thus, the insulation can be saved from being damaged by the gas.

[0048] As described above, since the gas can discharge through the penetration portion 412 located inside the sub-conductive layer 411, the discharging path of the gas generated from the insulating layer can be made shorter than the path through the outer portion of the sub-conductive layer 411. Thus, the processing time of the vacuum annealing process can be significantly reduced.

[0049] After that, as shown in FIG. 2E, a pixel defining layer 220 (for defining the pixels on the display area 200) can be formed on the substrate (except for at least a portion of a pixel opening portion 240 of the first electrode layer 210 and of the sub-conductive layer 411). The pixel defining layer can be formed by a spin coating process and a patterning process.

[0050] The stacked portion of the substrate 110 including the pixel defining layer 220 may be annealed in the vacuum environment to discharge the gas that can be generated from the pixel defining layer 220. Then, the organic EL unit 230 and the second electrode layer 400 may be sequentially formed on the portion including the pixel opening portion 240.

[0051] In FIG. 2A, one penetration portion 412 may be formed on the sub-conductive layer 411 corresponding to the insulating layer 180. However, two or more penetration portions 412 can be disposed on the sub-conductive layer 411 as shown in FIG. 3A. The via hole 182

denoted by a dotted line refers to the via hole 182 disposed on the rear portion. Since the penetration portions 412 have a particular size (through which the gas generated from the insulating layer 180 can discharge smoothly in the vacuum annealing process), it is desirable that a distance (dp) between the penetration holes 412 formed on the sub-conductive layer 411 be less than or equal to the maximum distance between two ends of the first electrode layer (210, refer to FIG. 6B).

[0052] It is desirable that the via hole of the insulating layer includes one or more penetration portions at least on the outer portion thereof. As shown in FIG. 3B, when two or more via holes 182 are formed on the insulating layer 180 on the electrode power supply line 410, a part of the insulating layer 180 can be surrounded by the sub-conductive layer 411. It may be desirable that one or more penetration portions 412 be disposed on the outer portion of the via hole 182 so that the gas generated from the surrounded portion of the insulating layer 180 can discharge smoothly.

[0053] The penetration portion formed on the sub-conductive layer 411 can be formed in various shapes. FIGS. 4A and 4B are expanded views of part "A" of FIG. 1 (the insulating layer is not shown). As shown in FIG. 4A, penetration holes 412a (which can serve as the penetration portions) can be formed on the sub-conductive layer 411. As shown in FIG. 4B, line type penetration portions 412b including a few straight lines can be formed if necessary to provide sufficient gas discharge. It may be desirable that one or more penetration portions 412a or 412b be formed on at least the outer portion of the via hole 182. The distance between the penetration portions 412a or 412b may be the less than or equal to the maximum distance between both ends of the first electrode layer.

[0054] In the examples shown in FIGS. 2B, 2C, 2D, 2E, 3A and 3B, the same layer may

be used as both the source/drain electrode 170 and the electrode power supply line 410.

However, this dual use single layer is not required. As shown in FIG. 5, in order to ensure sufficient conductivity in the electrode power supply line 410, it can include a layer 410b that is the same as the semiconductor active layer 130, and the layer 410a that is the same as the

source/drain electrode 170. Otherwise, the electrode power supply line 410 can include a layer 412b that is the same as the semiconductor active layer 130.

[0055] The sub-conductive layer 411 can be formed as one or more unit sub-conductive layers that are separated from each other. FIG. 6A is an expanded view showing part “A” of FIG. 1. The sub-conductive layer 411' can include one or more unit sub-conductive layers 411'a that are formed on the insulating layer 180 including the via hole 182. The sub-conductive layer 411' including the unit sub-conductive layers 411'a can be formed simultaneously with the first electrode layer 210 in the patterning process of the first electrode layer 210. The unit sub-conductive layers 411'a may be separated a predetermined distance  $d_a$  from each other. Thereby they may more quickly discharge the gas generated from the insulating layer 180 in the vacuum annealing process.

[0056] It may be desirable that the unit sub-conductive layer 411'a have a minimum size of a predetermined value to ensure that the gas discharge from the insulating layer 180 can be performed quickly enough. FIG. 6B is a schematic view showing a pixel on the display area 200, denoted by reference numeral “B” in FIG. 1. A first TFT (TFT1) may be the TFT that selects the pixel depending on the signal from the scan line, and a second TFT (TFT2) may be the TFT that supplies electric current to the first electrode layer 210 to drive the pixel according to electric signals from capacitor 131, 151, and 171. Here, two top-gate type TFTs and a multi-layered capacitor are used in the example shown in FIG. 6B, but the present invention is

not limited to this configuration.

[0057] It may be desirable that the distance between a point of the unit sub-conductive layer 411' and a neighboring outer point be less than or equal to the maximum distance ( $d_{ab}$ ) between a point Pa of the first electrode layer 210 and a neighboring outer point Pb. This situation may allow the gas generated from the insulating layer under the first electrode layer 210 to discharge sufficiently in the vacuum annealing process.

[0058] The above described embodiments are merely examples of the present invention, and the present invention is not limited to these embodiments. It can be modified in various respects if it includes the penetration portions formed on the sub-conductive layer that is disposed on the insulating layer including the via hole. In addition, the above embodiments describe with respect to organic EL devices, but the present invention can be applied to an inorganic EL device similarly.

[0059] According to the present invention, the insulating layer may be disposed between the electrode power supply line and the second electrode layer to prevent the electrode power supply line from peeling, and the sub-conductive layer may be formed between the electrode power supply line and the second electrode layer and may include penetration portions to prevent the electrode power supply line from being damaged and peeled. In addition, the gas generated from the organic insulating layer during a subsequent vacuum annealing process can discharge expediently, thereby reducing processing time and costs for manufacturing the device.

[0060] In addition, the penetration portion of the sub-conductive layer may be disposed on at least a part of the outer portion of the via hole and/or the distance between the penetration portions may be maintained constantly. Therefore, the gas generated from the insulating layer under the sub-conductive layer may not be captured by the sub-conductive layer, and can

discharge rapidly and expediently.

[0061] The sub-conductive layer can include the unit sub-conductive layers that are separated from each other and smaller than the first electrode layer. Thus gas generated from the insulating layer can discharge rapidly. In addition, the electrode power supply line of the present  
5 invention can include one or more conductive layers to ensure the sufficient conductivity.

[0062] Although the invention has been particularly described with reference to certain embodiments thereof, changes may be made to these embodiments without departing from the scope of the invention.

**WHAT IS CLAIMED IS:**

- 1           1.       An electroluminescence display device, comprising:  
2           a display area with pixels that have a first electrode layer and a second electrode layer on  
3           a substrate and an electroluminescence unit formed between the first electrode layer and the  
4           second electrode layer;  
5           an electrode power supply line to supply electrode power to the display area;  
6           an insulating layer disposed on the electrode power supply line, including a via hole and  
7           containing an organic material; and  
8           a sub-conductive layer formed on the insulating layer including the via hole along the  
9           electrode power supply line,  
10          wherein the electrode power supply line and the second electrode layer are coupled to  
11          each other at the via hole through the sub-conductive layer, and the sub-conductive layer on the  
12          insulating layer includes a penetration portion.
- 1           2.       The device of claim 1, wherein the sub-conductive layer comprises the same layer  
2           as at least a part of the first electrode layer.
- 1           3.       The device of claim 1, wherein the sub-conductive layer comprises two  
2           penetration portions, and a distance between the two penetration portions is less than or equal to  
3           a maximum distance between both ends of the first electrode layer.
- 1           4.       The device of claim 3, wherein at least one of the two penetration portions is  
2           disposed on at least a part of the outer portion of the via hole.

1           5.       The device of claim 1, wherein the penetration portion comprises a penetration  
2 hole.

1           6.       The device of claim 1, wherein the penetration portion comprises a line type  
2 penetration portion.

1           7.       The device of claim 1, wherein a thin film transistor layer is disposed under the  
2 first electrode layer, and the electrode power supply line comprises a layer that is the same layer  
3 as a source/drain electrode of the thin film transistor layer.

1           8.       The device of claim 1, wherein a thin film transistor layer is disposed under the  
2 first electrode layer, and the electrode power supply line comprises a layer that is the same layer  
3 as a semiconductor active layer of the thin film transistor layer.

1           9.       An electroluminescence display device, comprising:  
2           a display area with pixels that have a first electrode layer and a second electrode layer  
3 and an electroluminescence unit formed between the first electrode layer and the second  
4 electrode layer;  
5           an electrode power supply line to supply electrode power to the display area;  
6           an insulating layer disposed on the electrode power supply line, including a via hole and  
7 containing an organic material; and  
8           a sub-conductive layer comprising a plurality of unit sub-conductive layers formed on the  
9 insulating layer including the via hole along the electrode power supply line,

10            wherein the electrode power supply line and the second electrode layer are coupled to  
11            each other at the via hole through the sub-conductive layer, and the unit sub-conductive layers on  
12            the insulating layer are separated from each other.

1            10.     The device of claim 9, wherein a distance between a point of the unit  
2            sub-conductive layer and a neighboring outer point is less than or equal to a maximum distance  
3            between a point of the first electrode layer and a neighboring outer point.

1            11.     A method of manufacturing an electroluminescence display device, comprising:  
2            forming an insulating layer including an organic material on an electrode power supply  
3            line;  
4            forming a via hole on the insulating layer;  
5            forming a sub-conductive layer on the insulating layer including the via hole; and  
6            forming a penetration portion on the sub-conductive layer.

1            12.     The method of claim 11, wherein forming of the sub-conductive layer is  
2            simultaneous with forming a first electrode layer.

1            13.     The method of claim 11, wherein two or more via holes are formed when the via  
2            hole is formed, and the penetration portion is formed between the via holes when the penetration  
3            portion is formed.

1           14.     The method of claim 11, wherein forming the penetration portion comprises  
2     forming two or more penetration portions, and a distance between the penetration portions is less  
3     than or equal to a maximum distance between two ends of the first electrode layer.

1           15.     A method of manufacturing an electroluminescence display device, comprising:  
2     forming an insulating layer including an organic material on an electrode power supply  
3     line;  
4     forming a via hole on the insulating layer;  
5     forming a sub-conductive layer comprising a plurality of unit sub-conductive layers on  
6     the insulating layer.

### **ABSTRACT OF THE DISCLOSURE**

An electroluminescence (EL) display device can include a display area with pixels (each of which can include a first electrode layer and a second electrode layer on a substrate and electroluminescence units formed between the first and second electrode layers), an electrode power supply line supplying electrode power to the display area, one or more insulating layers disposed on the electrode power supply line (including one or more via holes and containing an organic material), and a sub-conductive layer formed on the insulating layer including the via hole along the electrode power supply line. In addition, the electrode power supply line and the second electrode layer may be coupled to each other at the via hole through the sub-conductive layer. The sub-conductive layer on the insulating layer can include one or more penetration portions.

FIG. 1

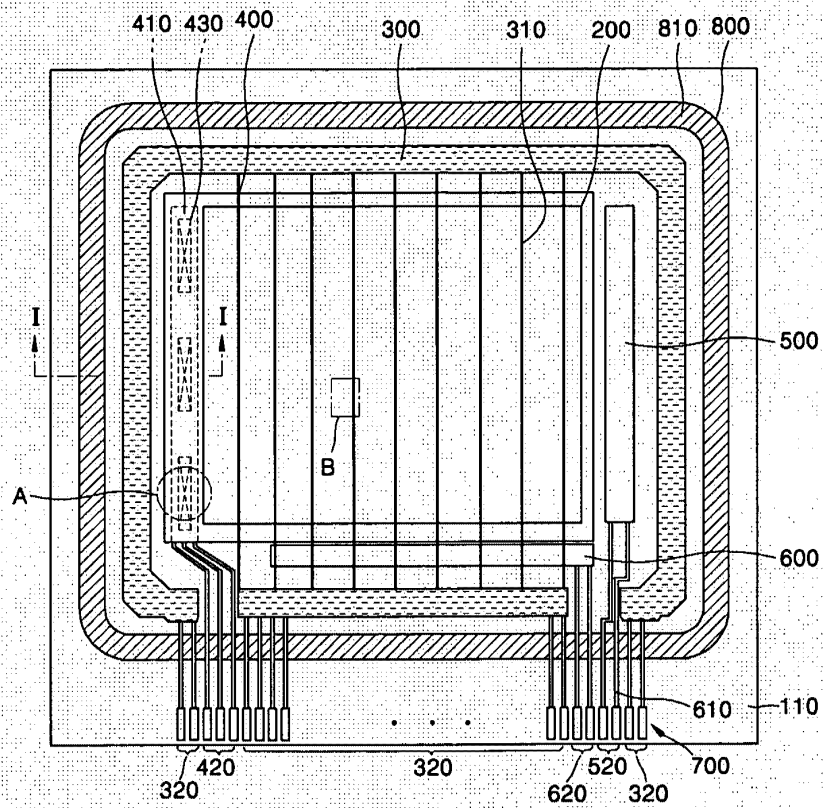


FIG. 2A

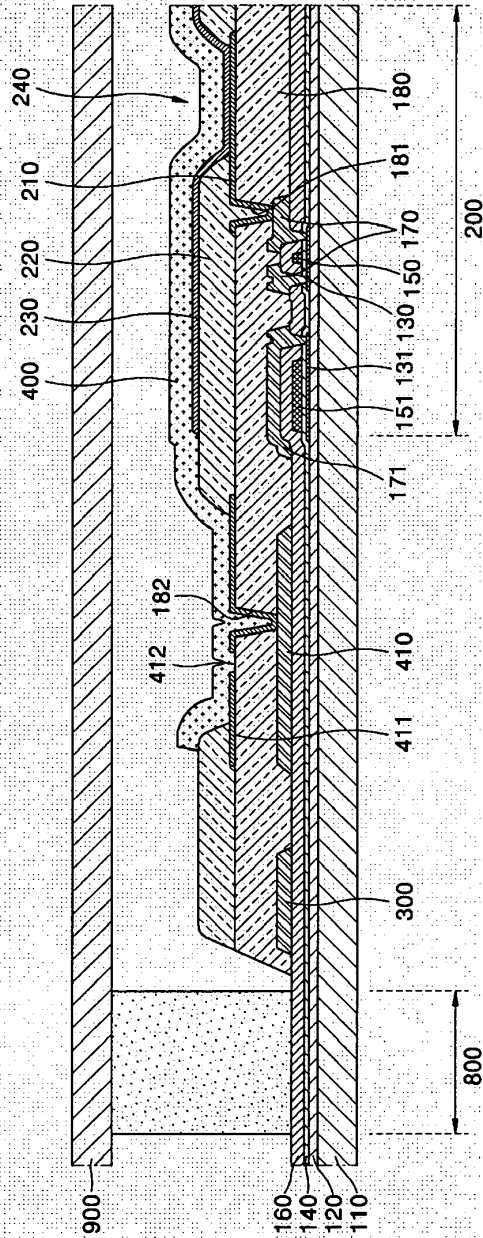


FIG. 2B

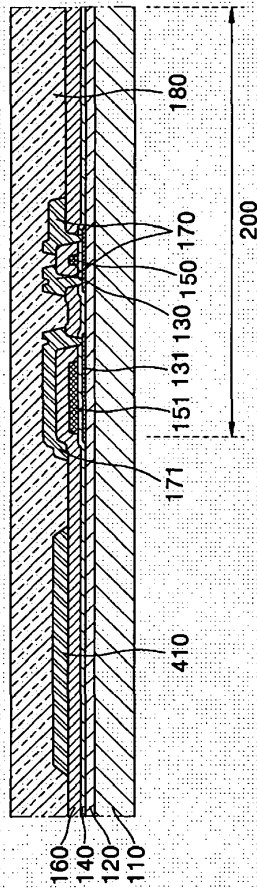


FIG. 2C

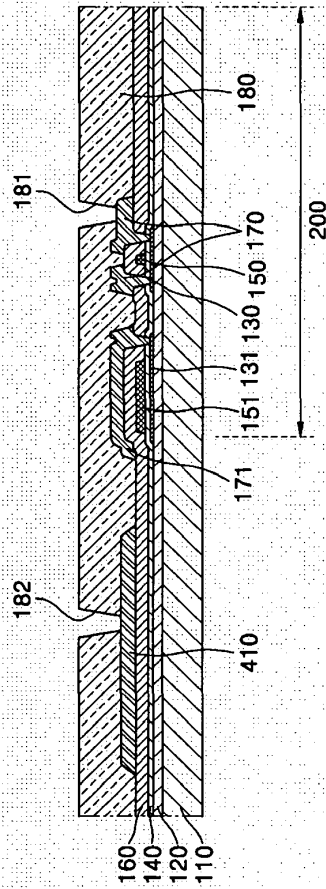


FIG. 2D

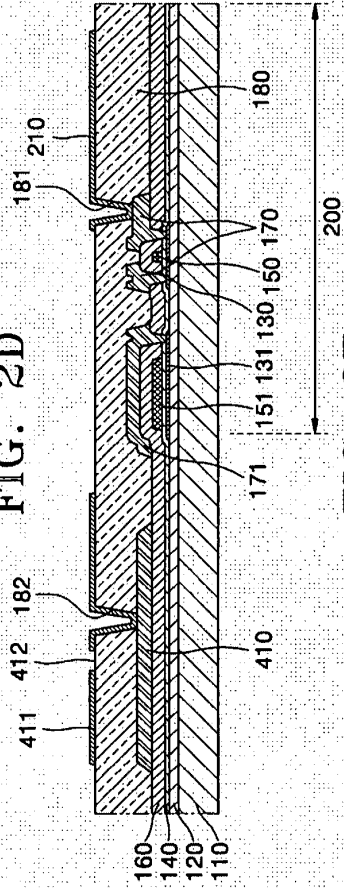
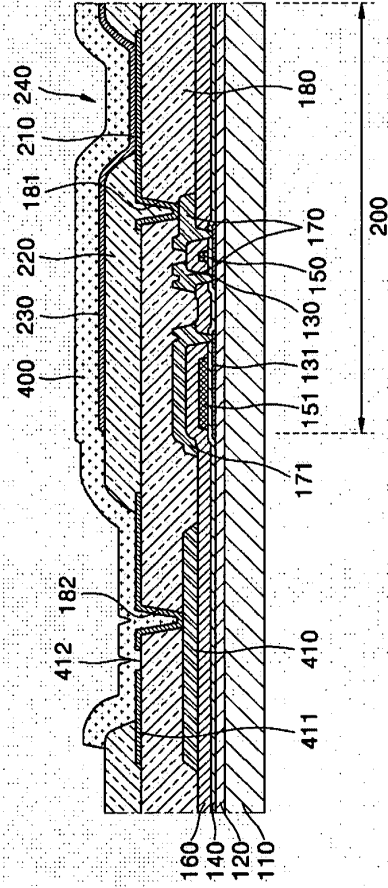


FIG. 2E



900

160

140

120

110

300

410

411

412

171

151

131

130

150

170

181

180

240

210

220

230

400

182

$d_b$

800

200

This cross-sectional diagram illustrates a semiconductor device. A substrate 900 is shown at the bottom. Above it is a gate stack 800, which includes layers 110, 120, 140, and 160. The gate stack 800 is divided into two regions by a vertical dashed line. To the left of this line is a region containing a series of gates 410, 411, and 412, which are connected to a common source/drain line 300. To the right of this line is a region containing a series of gates 171, 151, 131, 150, 170, 181, and 180. These gates are connected to a common source/drain line 240. The entire device is covered by a protective layer 200.

FIG. 4A

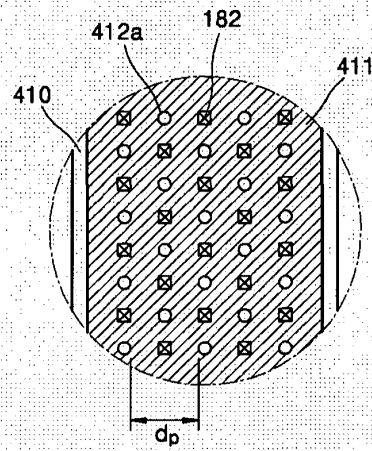


FIG. 4B

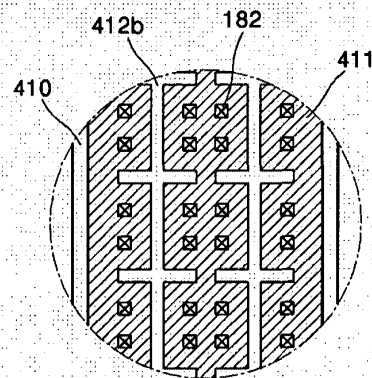


FIG. 5

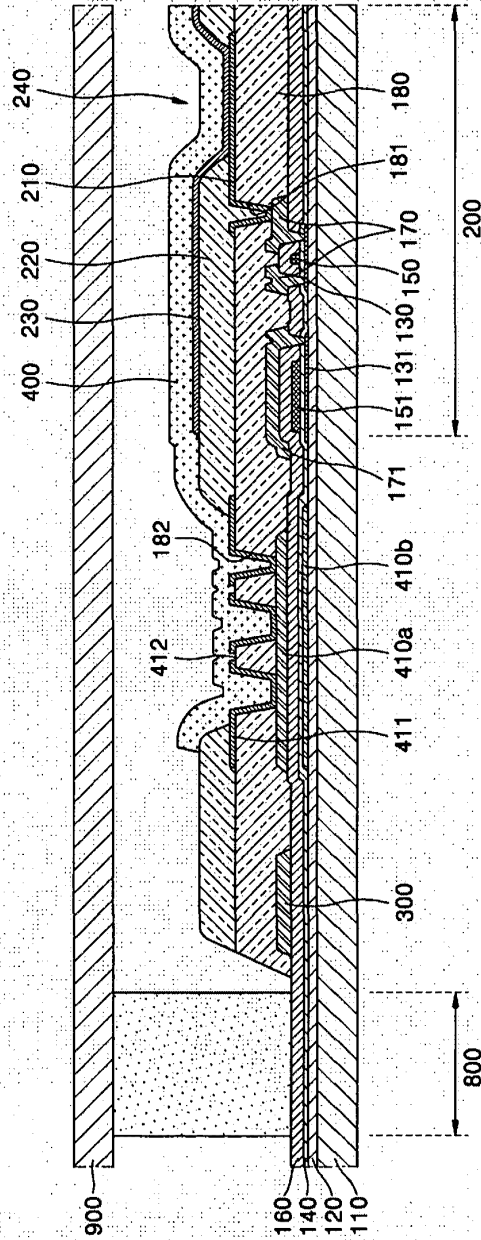


FIG. 6A

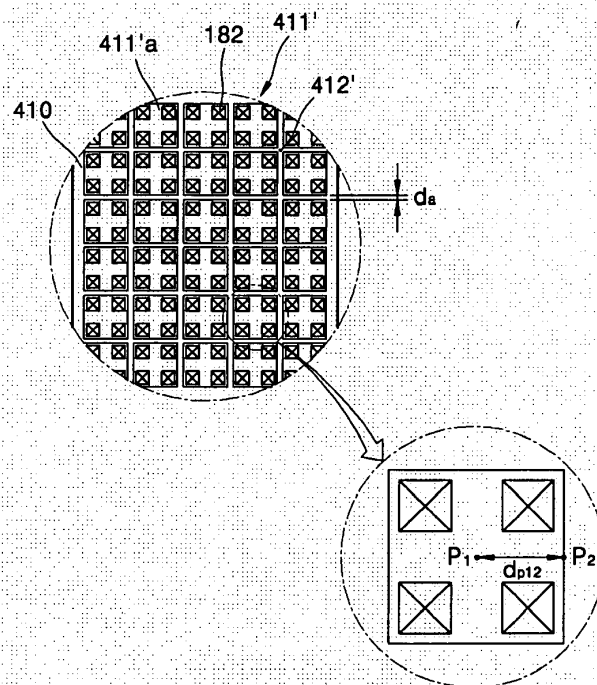
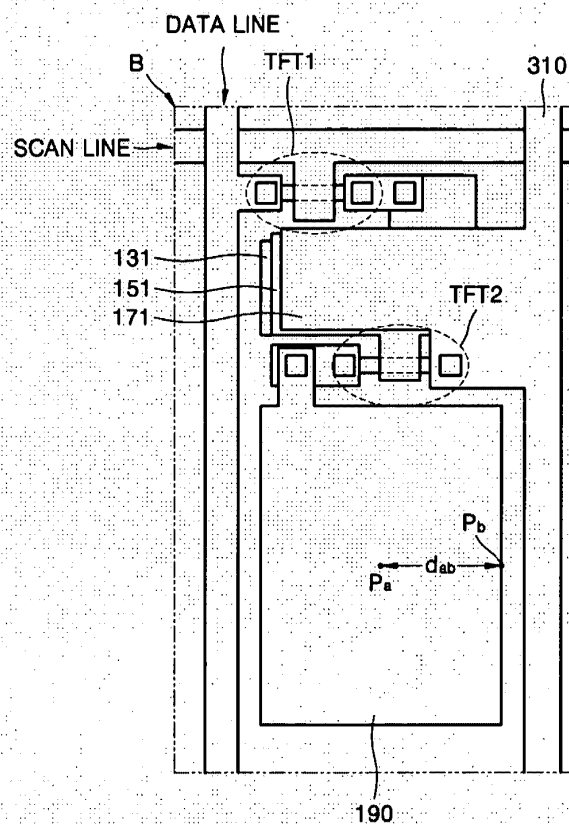


FIG. 6B



|                                                                                                                                                                                                                                                                                                                      |                          |                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------------------|
| <b>DECLARATION FOR UTILITY OR<br/>DESIGN PATENT APPLICATION</b><br><br><input checked="" type="checkbox"/> Declaration    -or- <input type="checkbox"/> Declaration<br><br>Submitted                      submitted<br>with initial                      after initial<br>filing                              filing | Docket No.:              | 6161.0533.US         |
|                                                                                                                                                                                                                                                                                                                      | First Named Inventor:    | Won-Kyu KWAK, et al. |
|                                                                                                                                                                                                                                                                                                                      | <i>Complete if known</i> |                      |
|                                                                                                                                                                                                                                                                                                                      | Application No:          | Unassigned           |
|                                                                                                                                                                                                                                                                                                                      | Application Filing Date: | Concurrently         |
|                                                                                                                                                                                                                                                                                                                      | Group Art Unit:          | Unassigned           |
|                                                                                                                                                                                                                                                                                                                      | Examiner Name:           | Unassigned           |

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**ELECTROLUMINESCENCE DISPLAY DEVICE AND METHOD OF MANUFACTURING  
THE SAME**

The specification of which:

(check one)      ☒ is attached hereto  
☐ was filed on  
as Application Serial No.  
and was amended on \_\_\_\_\_  
(if applicable)

**ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR**

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56.

**37, Code of Federal Regulations, § 1.56**

- (a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith toward the Patent and Trademark Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned.
- (b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and (1) it establishes, by itself or in combination with other information, a prima facie case of unpatentability; or (2) it refutes, or is inconsistent with, a position the applicant takes in: (i) opposing an argument of unpatentability relied on by the Office, or (ii) asserting an argument of patentability.

McGUIREWOODS

## PRIORITY CLAIMS

### Foreign and Provisional Applications

| I hereby claim foreign priority benefits under Title 35, United States Code § 119(a)-(d) or (f) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365 (a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed. I hereby also claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below. |                        |                          |                          |                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|--------------------------|--------------------------|---------------------------------------------------|
| Prior Application Number(s)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Country or Provisional | Filing Date (MM/DD/YYYY) | Priority Not Claimed     | Certified Copy Attached?<br>Yes - No              |
| 10-2004-0038735                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Korea                  | 05/29/2004               | <input type="checkbox"/> | <input type="checkbox"/> <input type="checkbox"/> |
| <input type="checkbox"/> Additional foreign, PCT and/or provisional application numbers are listed on a supplemental priority sheet attached hereto.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                        |                          |                          |                                                   |

### U.S. and PCT Applications

| I hereby claim the benefit under Title 35, United States Code § 120 of any United States application(s), or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of the Federal Regulations § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application. |                   |                                 |                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------------------|-----------------------------------------|
| U.S. Parent Application Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | PCT Parent Number | Parent Filing Date (MM/DD/YYYY) | Parent Patent Number<br>(if applicable) |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                                 |                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                                 |                                         |
| <input type="checkbox"/> Additional U.S. and/or PCT international application numbers are listed on a supplemental priority sheet attached hereto.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                                 |                                         |

## DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of Sole

or First Inventor Won-Kyu KWAK

Inventor's Signature \_\_\_\_\_ Date \_\_\_\_\_

Residence 207-903 Kachi Jugong Apt. 88, Gumi-dong, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea

Citizenship Republic of Korea

Post Office Address Same as above

Full Name of

Second Inventor Kwan-Hee LEE

Inventor's Signature \_\_\_\_\_ Date \_\_\_\_\_

Residence 1630-5 Bongcheon-dong, Gwanak-gu, Seoul, Republic of Korea

Citizenship Republic of Korea

Post Office Address Same as above

Full Name of

Third Inventor Seung-Yong SONG

Inventor's Signature \_\_\_\_\_ Date \_\_\_\_\_

Residence 405-902 Shinyoungtong Hyundai Apt., 870 Banwol-ri, Taeon-eup, Hwaseong-si, Gyeonggi-do, Republic of Korea

Citizenship Republic of Korea

Post Office Address Same as above

PATENT APPLICATION SERIAL NO. \_\_\_\_\_

U.S. DEPARTMENT OF COMMERCE  
PATENT AND TRADEMARK OFFICE  
FEE RECORD SHEET

05/31/2005 FFANAEIA 00000054 11138323

|            |           |
|------------|-----------|
| 01 FC:1011 | 300.00 OP |
| 02 FC:1111 | 500.00 OP |
| 03 FC:1311 | 200.00 OP |
| 04 FC:1201 | 200.00 OP |

Repln. Ref: 06/07/2005 SSITHIB1 0013394900  
DAH:231951 Name/Number:11138323  
FC: 9204 \$40.00 CR

PTO-1556  
(5/87)

\*U.S. Government Printing Office: 2002 — 489-267/89003

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

**PATENT APPLICATION FEE DETERMINATION RECORD**

Substitute for Form PTO-875 Effective December 8, 2004

Application or Pocket Number

11 38323

**APPLICATION AS FILED - PART I**

(Column 1)

(Column 2)

SMALL ENTITY

OR

OTHER THAN  
SMALL ENTITY

| FOR                                               | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| BASIC FEE<br>(37 CFR 1.18(a), (b), or (c))        | N/A                                                                                                                                                                                                                           | N/A          |
| SEARCH FEE<br>(37 CFR 1.18(k), (l), or (m))       | N/A                                                                                                                                                                                                                           | N/A          |
| EXAMINATION FEE<br>(37 CFR 1.18(o), (p), or (q))  | N/A                                                                                                                                                                                                                           | N/A          |
| TOTAL CLAIMS<br>(37 CFR 1.16(i))                  | 15 minus 20 =                                                                                                                                                                                                                 | 0            |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))            | 4 minus 3 =                                                                                                                                                                                                                   | 1            |
| APPLICATION SIZE FEE<br>(37 CFR 1.16(s))          | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |              |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) |                                                                                                                                                                                                                               |              |

| RATE (\$) | FEE (\$) |
|-----------|----------|
| N/A       | 150.00   |
| N/A       | \$250    |
| N/A       | \$100    |
| X\$ 25 =  |          |
| X100 =    |          |
| +180=     |          |
| TOTAL     |          |

| RATE (\$) | FEE (\$) |
|-----------|----------|
| N/A       | 300.00   |
| N/A       | \$500    |
| N/A       | \$200    |
| X\$50 =   |          |
| X200 =    | See      |
| +360=     |          |
| TOTAL     | See      |

\* If the difference in column 1 is less than zero, enter "0" in column 2.

**APPLICATION AS AMENDED - PART II**

(Column 1)

(Column 2)

(Column 3)

SMALL ENTITY

OR

OTHER THAN  
SMALL ENTITY

| AMENDMENT A                                                     | CLAIMS REMAINING AFTER AMENDMENT | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA |
|-----------------------------------------------------------------|----------------------------------|------------------------------------|---------------|
|                                                                 | Total<br>(37 CFR 1.16(i))        | 0                                  | Minus **      |
| Independent<br>(37 CFR 1.16(h))                                 | 0                                | Minus ***                          | =             |
| Application Size Fee (37 CFR 1.16(s))                           |                                  |                                    |               |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                  |                                    |               |

| RATE (\$)       | ADDITIONAL FEE (\$) |
|-----------------|---------------------|
| X\$ 25 =        |                     |
| X100 =          |                     |
| +180=           |                     |
| TOTAL ADD'L FEE |                     |

| RATE (\$)       | ADDITIONAL FEE (\$) |
|-----------------|---------------------|
| X\$50 =         |                     |
| X200 =          |                     |
| +360=           |                     |
| TOTAL ADD'L FEE |                     |

9 - 11 - 15

(Column 1)

(Column 2)

(Column 3)

| AMENDMENT B                                                     | CLAIMS REMAINING AFTER AMENDMENT | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA |
|-----------------------------------------------------------------|----------------------------------|------------------------------------|---------------|
|                                                                 | Total<br>(37 CFR 1.16(i))        | 0                                  | Minus **      |
| Independent<br>(37 CFR 1.16(h))                                 | 0                                | Minus ***                          | =             |
| Application Size Fee (37 CFR 1.16(s))                           |                                  |                                    |               |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                  |                                    |               |

| RATE (\$)       | ADDITIONAL FEE (\$) |
|-----------------|---------------------|
| X\$ 25 =        |                     |
| X100 =          |                     |
| +180=           |                     |
| TOTAL ADD'L FEE |                     |

| RATE (\$)       | ADDITIONAL FEE (\$) |
|-----------------|---------------------|
| X\$50 =         |                     |
| X200 =          |                     |
| +360=           |                     |
| TOTAL ADD'L FEE |                     |

\* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

\*\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:  
Won-Kyu KWAK, et al.

Group Art Unit: unassigned

Application No.: unassigned

Examiner: *To be assigned*

Filed: 27 May 2005

Attorney Docket: 6161.0533.US

Confirmation No.: unassigned

For: **ELECTROLUMINESCENCE  
DISPLAY DEVICE AND METHOD  
OF MANUFACTURING THE SAME**

**Claim For Priority Under 35 U.S.C. § 119 In Utility Application**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

Sir:

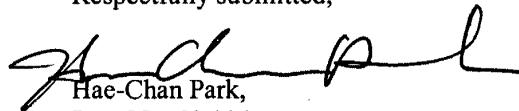
Priority under 35 U.S.C. § 119 is hereby claimed to the following priority document(s), filed in a foreign country within twelve (12) months prior to the filing of the above-referenced United States utility patent application:

| Country | Priority Document Appl. No. | Filing Date |
|---------|-----------------------------|-------------|
| KOREA   | 10-2004-0038735             | 29 May 2004 |

A certified copy of Korean Patent Application No. 10-2004-0038735 is submitted

herewith. Prompt acknowledgment of this claim is respectfully requested.

Respectfully submitted,

  
Hae-Chan Park,  
Reg. No. 50,114

Date: 27 May 2005  
McGuireWoods LLP  
1750 Tysons Boulevard, Suite 1800  
McLean, VA 22102  
Telephone No. 703-712-5365  
Facsimile No. 703-712-5280  
**Customer Number 23345**  
HCP:PCF/tmf



별첨 사본은 아래 출원의 원본과 동일함을 증명함.

This is to certify that the following application annexed hereto  
is a true copy from the records of the Korean Intellectual  
Property Office.

출원 번호 : 10-2004-0038735  
Application Number

출원 년 월 일 : 2004년 05월 29일  
Date of Application MAY 29, 2004

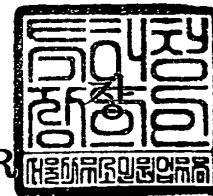
출원인 : 삼성에스디아이 주식회사  
Applicant(s) SAMSUNG SDI CO., LTD.



2004 년 09 월 16 일

특 허 청

COMMISSIONER



## 【서지사항】

|            |                                                                          |
|------------|--------------------------------------------------------------------------|
| 【서류명】      | 특허출원서                                                                    |
| 【권리구분】     | 특허                                                                       |
| 【수신처】      | 특허청장                                                                     |
| 【창조번호】     | 0006                                                                     |
| 【제출일자】     | 2004.05.29                                                               |
| 【국제특허분류】   | H05B                                                                     |
| 【발명의 명칭】   | 전계 발광 디스플레이 장치 및 이의 제조 방법                                                |
| 【발명의 영문명칭】 | Electroluminescence display device and method for manufacturing the same |
| 【출원인】      |                                                                          |
| 【명칭】       | 삼성에스디아이 주식회사                                                             |
| 【출원인코드】    | 1-1998-001805-8                                                          |
| 【대리인】      |                                                                          |
| 【성명】       | 이영필                                                                      |
| 【대리인코드】    | 9-1998-000334-6                                                          |
| 【포괄위임등록번호】 | 1999-050326-4                                                            |
| 【대리인】      |                                                                          |
| 【성명】       | 이해영                                                                      |
| 【대리인코드】    | 9-1999-000227-4                                                          |
| 【포괄위임등록번호】 | 2000-004535-8                                                            |
| 【발명자】      |                                                                          |
| 【성명의 국문표기】 | 곽원규                                                                      |
| 【성명의 영문표기】 | KWAK, Won Kyu                                                            |
| 【주민등록번호】   | 721108-1396516                                                           |
| 【우편번호】     | 463-500                                                                  |
| 【주소】       | 경기도 성남시 분당구 구미동 88번지 까치주공아파트 207동 903호                                   |
| 【국적】       | KR                                                                       |
| 【발명자】      |                                                                          |
| 【성명의 국문표기】 | 이관희                                                                      |
| 【성명의 영문표기】 | LEE, Kwan Hee                                                            |
| 【주민등록번호】   | 681212-1379723                                                           |

1020040038735

출력 일자: 2004/9/17

|            |                                                                                  |
|------------|----------------------------------------------------------------------------------|
| 【우편번호】     | 151-050                                                                          |
| 【주소】       | 서울특별시 관악구 봉천동 1630-5                                                             |
| 【국적】       | KR                                                                               |
| 【발명자】      |                                                                                  |
| 【성명의 국문표기】 | 송승용                                                                              |
| 【성명의 영문표기】 | SONG, Seung Yong                                                                 |
| 【주민등록번호】   | 720728-1009743                                                                   |
| 【우편번호】     | 445-973                                                                          |
| 【주소】       | 경기도 화성군 태안읍 반월리 870번지 신영통현대아파트 405동 902호                                         |
| 【국적】       | KR                                                                               |
| 【심사청구】     | 청구                                                                               |
| 【취지】       | 특허법 제42조의 규정에 의한 출원, 특허법 제60조의 규정에 의한 출원심사를 청구합니다. 대리인<br>이영필 (인) 대리인<br>이해영 (인) |
| 【수수료】      |                                                                                  |
| 【기본출원료】    | 0 면 38,000 원                                                                     |
| 【가산출원료】    | 36 면 0 원                                                                         |
| 【우선권주장료】   | 0 건 0 원                                                                          |
| 【심사청구료】    | 15 항 589,000 원                                                                   |
| 【합계】       | 627,000 원                                                                        |
| 【첨부서류】     | 1. 요약서·명세서(도면)_1통                                                                |

**【요약서】****【요약】**

본 발명은, 기판 일면 상부의, 하나 이상의 층을 갖는 제 1 전극층 및 제 2 전극층, 그리고 이들 사이에 형성된 전계 발광부를 갖는 화소들을 구비하는 디스플레이 영역과, 상기 디스플레이 영역에 전극 전원을 공급하는 전극 전원 공급 라인을 포함하는 전계 발광 디스플레이 장치에 있어서,

상기 전극 전원 공급 라인 상부에 배치되고, 하나 이상의 비아홀을 구비하며, 유기물을 포함하는 하나 이상의 절연층과;

상기 전극 전원 공급 라인을 따라, 상기 비아홀을 포함한, 상기 절연층의 일면 상에 형성되는 보조 도전층;을 더 포함하고,

상기 전극 전원 공급 라인과 상기 제 2 전극층 사이의 전기적 소통은 상기 비아홀에서 상기 보조 도전층을 통하여 이루어지되, 상기 절연층 일면 상의 보조 도전층에는 하나 이상의 관통부가 구비되는 것을 특징으로 하는 전계 발광 디스플레이 장치 및 이를 제조하는 방법을 제공한다.

**【대표도】**

도 2a

## 【명세서】

## 【발명의 명칭】

전계 발광 디스플레이 장치 및 이의 제조 방법{Electroluminescence display device and method for manufacturing the same}

## 【도면의 간단한 설명】

도 1은 본 발명의 일실시예에 따른 유기 전계 발광 디스플레이 장치의 개략적인 평면도,  
도 2a는 도 1의 선 I-I를 따라 취한 부분 단면도,  
도 2b 내지 도 2f는 도 2a에 도시된 본 발명의 일실시예를 제조하는 과정을 나타내는 단면도,

도 3a는 본 발명의 다른 일실시예에 따른 유기 전계 발광 디스플레이 장치의 개략적인 부분 단면도,

도 3b는 본 발명의 또 다른 일실시예에 따른 유기 전계 발광 디스플레이 장치의 개략적인 부분 단면도,

도 4a 및 도 4b는 본 발명에 따른 다양한 형태의 보조 도전층을 도시하는 부분 확대도,  
도 5는 본 발명의 또 다른 일실시예에 따른 유기 전계 발광 디스플레이 장치의 개략적인 부분 단면도,

도 6a는 본 발명의 또 다른 일실시예에 따른 보조 도전층을 도시하는 부분 확대도,  
도 6b는 도 1의 "B"를 확대한 부분 단면도.

<도면의 주요부분에 대한 부호의 간단한 설명>

110...기판      120...버퍼층

130...반도체 활성층 140...게이트 절연층

150...게이트 전극 160...중간층

170...소스 및 드레인 전극 180...보호층

300...구동 전원 공급 라인 400...제 2 전극층

410...전극 전원 공급 라인 500...수직 구동 회로부

600...수평 구동 회로부 800...밀봉부

#### 【발명의 상세한 설명】

#### 【발명의 목적】

#### 【발명이 속하는 기술분야 및 그 분야의 종래기술】

<18> 본 발명은 평판 디스플레이 장치에 관한 것으로, 보다 상세하게는 기판 사이즈 대비 디스플레이 영역의 비율을 증대시키고, 전극 전압 공급 시 발생 가능한 전압 강하를 줄여 디스플레이 영역의 휘도 불균일을 감소시킬 수 있는 유기 전계 발광 디스플레이 장치에 관한 것이다.

<19> 화상을 표시하는데 있어, 수많은 종류의 디스플레이 장치가 사용되는데, 근래에는 종래의 브라운관, 즉 CRT(cathode ray tube, 음극선관)를 대체하는 다양한 평판 디스플레이 장치가 사용된다. 이러한 평판 디스플레이 장치는 발광 형태에 따라 자발광형(emissive)과 비자발광형(non-emissive)으로 분류할 수 있다. 자발

광형 디스플레이 장치에는 평면 브라운관, 플라즈마 디스플레이 장치(plasma display panel device), 진공 형광 표시 장치(vacuum fluorescent display device), 전계 방출 디스플레이 장치(field emission display device), 무기/유기 전계 발광 디스플레이 소자(electro-luminescent display device) 등이 있고, 비자발광형 디스플레이 장치에는 액정 디스플레이 장치(liquid crystal display device)가 있다. 그 중에서도, 유기 전계 발광 소자는 백라이트와 같은 별도의 발광 장치 필요없는 자발광형 소자로서, 저전력 및 고효율 작동이 가능하고, 청색 발광이 가능하다는 근래에 각광을 받고 있는 평면 디스플레이 소자이다.

<20> 유기 전계 발광 디스플레이 소자는 유기물 박막에 음극과 양극을 통하여 주입된 전자와 정공(hole)이 재결합하여 여기자(exiton)를 형성하고, 형성된 여기자로부터의 에너지에 의해 특정한 파장의 빛이 발생하는 현상을 이용하는 자발광형 디스플레이 장치이다. 유기 전계 발광 디스플레이 장치는 저전압으로 구동이 가능하고, 경량의 박형이고, 시야각이 넓을 뿐만 아니라, 응답 속도 또한 빠르다는 장점을 구비한다.

<21> 이러한 유기 전계 발광 디스플레이 소자의 유기 전계 발광부는 기판 상에 적층식으로 형성되는 양극으로서의 제 1 전극, 유기 발광부, 및 음극으로서의 제 2 전극으로 구성된다. 유기 발광부는 유기 발광층(EML, emitting layer)을 구비하는데, 이 유기 발광층에서 정공과 전자가 재결합하여 여기자를 형성하고 빛이 발생한다. 발광 효율을 보다 높이기 위해서는 정공과 전자를 유기 발광층으로 보다 원활하게 수송하여야 하고, 이를 위해 음극과 유기 발광층 사이에는 전자 수송층(ETL, electron transport layer)이 배치될 수 있고 양극과 유기 발광층 사이에는 정공 수송층(HTL, hole transport layer)이 배치될 수 있으며, 또한 양극과 정공 수송층 사이에 정공 주입층(HIL, hole injection layer)이 배치될 수도 있고, 음극과 전자 수송층 사이에 전자 주입층(EIL, electron injection layer)이 배치될 수도 있다.

<22> 한편, 유기 전계 발광 디스플레이 소자는 구동 방식에 따라, 수동 구동방식의 패시브 매트릭스(Passive Matrix: PM)형과, 능동 구동방식의 액티브 매트릭스(Active Matrix: AM)형으로 구분된다. 상기 패시브 매트릭스형은 단순히 양극과 음극이 각각 컬럼(column)과 로우(row)로 배열되어 음극에는 로우 구동회로로부터 스캐닝 신호가 공급되고, 이 때, 복수의 로우 중 하나의 로우만이 선택된다. 또한, 컬럼 구동회로에는 각 화소로 데이터 신호가 입력된다. 한편, 상기 액티브 매트릭스형은 박막 트랜지스터(Thin Film Transistor, TFT)를 이용해 각 화소 당 입력되는 신호를 제어하는 것으로 방대한 양의 신호를 처리하기에 적합하여 동영상을 구현하기 위한 디스플레이 장치로서 많이 사용되고 있다.

<23> 이와 같이, 디스플레이 해상도 증대 및 대형화 추세에 따라, 소비 전력을 저감시키고 휘도 등과 같은 화면 품질을 증대시키기 위한 다양한 방안이 연구되고 있다. 그 중 한 방안은, 디스플레이 영역에 전원을 공급하는 구동 전원 공급 라인 및 전극 전원 공급 라인 등과 같은 각종 배선에서의 배선 저항을 저감시켜 휘도 저하 내지 휘도 불균일과 같은 문제를 해결하고자 하는 것이다.

<24> 일본특허공개공보 제 2001-109395호에는 음극과 단자 사이에서 광폭부의 컨택부를 통하여 전기적으로 접속되며 양극과 동일한 산화물로 형성되는 전극이 형성된 유기 발광 표시 장치가 개시되어 있는데, 이와 같은 구조를 통하여 음극과 단자가 직접 접속함으로써 발생하는 접촉 저항을 줄여 화면 품질을 증대시킬 수 있다.

<25> 하지만, 이러한 종래 기술에 따르면, 단자 광폭부의 컨택부에서 단자 상부의 절연층이 대부분 제거되어 단자가 과도하게 외부로 노출됨으로써, 후속 진행되는 공정에서 단자를 구성하는 층이 박리(peeling)되거나 상당한 손상을 입을 수도 있다. 또한, 양극과 동일한 산화물로 형성되는 전극 하부에는 아크릴계 수지로 구성되는 평탄화층이 배치되는데, 이로부터 발생

성되는 보조 도전을; 를 더 포함하고,

<30> 상기 전극 전원 공극 라인을 따라, 상기 비아홀을 포함한, 상기 절연층의 일면 상에 형성되는 보조 도전층; 를 더 포함하고,

포함하는 하나 이상의 절연층과;

<29> 상기 전극 전원 공극 라인 상부에 배치되고, 하나 이상의 비아홀을 구비하며, 유기물층

판 디스플레이 장치에 있어서,

<28> 상기 디스플레이 영역에 전극 전원을 공급하는 전극 전원 공극 라인을 포함하는 전계 발

광 디스플레이 영역과,

나 이상의 층을 갖는 제 1 전극층 및 제 2 전극층, 그리고 이를 사이에 형성된 전계 발광부를

<27> 상기와 같은 목적을 달성하기 위하여, 본 발명의 일면에 따르면, 기판 일면 상부의, 하

【발명의 구성 및 작용】

한다.

시될 수 있는 구조의 전계 발광 디스플레이 장치 및 이를 제조하는 방법을 제공함을 목적으로

는 박막을 방지함과 동시에 유기물 층을 포함하는 절연층에서 발생하는 가스를 원활하게 배출

<26> 본 발명은, 상기와 같은 문제를 해소시킬 수 있도록, 전극 전원 공극 라인의 손상 및/또

【발명이 이루고자 하는 기술적 과제】

증대와 같은 손실을 발생시킬 수도 있다.

내지 권입점으로 인하여 발생 가스가 원활히 배출되지 않음으로써 제품 불량 내지 공정 시간

하는 가스가 상부에 배치된 양극과 동일한 산화물로 형성되는 전극에 의하여 배출 경로가 차단

등록일자: 2004/9/17

1020040038735

- <31>       상기 전극 전원 공급 라인과 상기 제 2 전극층 사이의 전기적 소통은 상기 비아홀에서  
상기 보조 도전층을 통하여 이루어지되, 상기 절연층 일면 상의 보조 도전층에는 하나 이상의  
관통부가 구비되는 것을 특징으로 하는 전계 발광 디스플레이 장치를 제공한다.
- <32>       본 발명의 다른 일면에 따르면, 상기 보조 도전층은 상기 제 1 전극층의 적어도 일부와  
동일층인 것을 특징으로 하는 전계 발광 디스플레이 장치를 제공한다.
- <33>       본 발명의 또 다른 일면에 따르면, 상기 보조 도전층에는 둘 이상의 관통부들이 구비되  
고,
- <34>       상기 관통부들 사이의 거리는, 상기 화소 제 1 전극층 양단 간 거리중 최대 거리 이하인  
것을 특징으로 하는 전계 발광 디스플레이 장치를 제공한다.
- <35>       본 발명의 또 다른 일면에 따르면, 상기 비아홀 외측의 적어도 일부에는 하나 이상의 관  
통부가 구비되는 것을 특징으로 하는 전계 발광 디스플레이 장치를 제공한다.
- <36>       본 발명의 또 다른 일면에 따르면, 상기 관통부는 하나 이상의 관통공을 포함하는 것을  
특징으로 하는 전계 발광 디스플레이장치를 제공한다.
- <37>       본 발명의 또 다른 일면에 따르면, 상기 관통부는 라인 타입 관통부를 포함하는 것을 특  
징으로 하는 전계 발광 디스플레이 장치를 제공한다.
- <38>       본 발명의 또 다른 일면에 따르면, 상기 제 1 전극층 하부에는 박막 트랜지스터 층을 구  
비하고,
- <39>       상기 전극 전원 공급 라인에는 상기 박막 트랜지스터 층의 소스/드레인 전극과 동일층을  
포함하는 것을 특징으로 하는 전계 발광 디스플레이 장치를 제공한다.

- <40> 본 발명의 또 다른 일면에 따르면, 상기 제 1 전극층 하부에는 박막 트랜지스터 층을 구비하고,
- <41> 상기 전극 전원 공급 라인에는 상기 박막 트랜지스터 층의 반도체 활성층과 동일층을 포함하는 것을 특징으로 하는 전계 발광 디스플레이 장치를 제공한다.
- <42> 본 발명의 또 다른 일면에 따르면, 기판 일면 상부의, 하나 이상의 층을 갖는 제 1 전극층 및 제 2 전극층, 그리고 이들 사이에 형성된 전계 발광부를 갖는 화소들을 구비하는 디스플레이 영역과,
- <43> 상기 디스플레이 영역에 전극 전원을 공급하는 전극 전원 공급 라인을 포함하는 전계 발광 디스플레이 장치에 있어서,
- <44> 상기 전극 전원 공급 라인 상부에 배치되고, 하나 이상의 비아홀을 구비하며, 유기물을 포함하는 하나 이상의 절연층과;
- <45> 상기 전극 전원 공급 라인을 따라, 상기 비아홀을 포함한, 상기 절연층의 일면 상에 형성되는 하나 이상의 단위 보조 도전층으로 구성되는 보조 도전층;을 더 포함하고,
- <46> 상기 전극 전원 공급 라인과 상기 제 2 전극층 사이의 전기적 소통은 상기 비아홀에서 상기 보조 도전층을 통하여 이루어지되, 상기 절연층 일면 상의 단위 보조 도전층들은 서로 이격되어 있는 것을 특징으로 하는 전계 발광 디스플레이 장치를 제공한다.
- <47> 본 발명의 또 다른 일면에 따르면, 상기 단위 보조 도전층의 일지점 및 인접 외곽 지점 사이의 거리는, 상기 화소 제 1 전극층 일지점 및 인접 외곽 지점 사이 최대 거리 이하인 것을 특징으로 하는 전계 발광 디스플레이 장치를 제공한다.

1020040038735  
 등록일자: 2004/9/17

<48> 본 발명의 또 다른 일면에 따르면, 기관 일면 상부의, 하나 이상의 증을 갖는 제 1 전극을 및 제 2 전극을, 그리고 이를 사이에 형성된 전계 발광부를 갖는 화소들을 구비하는 디스플레이 영역과,

<49> 상기 디스플레이 영역에 전극 전원을 공급하는 전극 라인을 포함하는 전계 발광 디스플레이 장치를 제조하는 방법에 있어서,

<50> 상기 전극 전원 공급 라인 상부에 유기물을 포함하는 하나 이상의 절연층을 형성하는 단계;

계;

<51> 상기 하나 이상의 절연층에 하나 이상의 비아홀을 형성하는 단계;

<52> 상기 비아홀을 포함한 상기 절연층의 일면 상에 보즈 도전층을 형성하는 단계;

<53> 상기 절연층 일면 상의 보즈 도전층에 관통부를 형성하는 단계를 포함하는 것을 특징으로

로 하는 전계 발광 디스플레이 장치 제조 방법을 제공한다.

<54> 본 발명의 또 다른 일면에 따르면, 상기 보즈 도전층 형성 단계는, 상기 하나 이상의 제 1 전극층의 적어도 일부를 형성함과 동시에 실시되는 것을 특징으로 하는 전계 발광 디스플레이 장치 제조 방법을 제공한다.

<55> 본 발명의 또 다른 일면에 따르면, 상기 비아홀 형성 단계시, 물 이상의 비아홀이 형성되고,

<56> 상기 관통부 형성 단계시, 상기 관통부는 적어도 상기 비아홀들 사이에 형성되는 것을 특징으로 하는 전계 발광 디스플레이 장치 제조 방법을 제공한다.

- <57> 본 발명의 또 다른 일면에 따르면, 상기 관통부 형성 단계시, 둘 이상의 관통부를 형성 하되, 상기 관통부 사이의 거리는, 상기 화소 제 1 전극층 양단 간의 최대 거리 이하이도록 형성하는 것을 특징으로 하는 전계 발광 디스플레이 장치 제조 방법을 제공한다.
- <58> 본 발명의 또 다른 일면에 따르면, 기관 일면 상부의, 하나 이상의 층을 갖는 제 1 전극 층 및 제 2 전극층, 그리고 이들 사이에 형성된 전계 발광부를 갖는 화소들을 구비하는 디스플레이 영역과,
- <59> 상기 디스플레이 영역에 전극 전원을 공급하는 전극 전원 공급 라인을 포함하는 전계 발광 디스플레이 장치를 제조하는 방법에 있어서,
- <60> 상기 전극 전원 공급 라인 상부에 유기물을 포함하는 하나 이상의 절연층을 형성하는 단계;
- <61> 상기 하나 이상의 절연층에 하나 이상의 비아홀을 형성하는 단계;
- <62> 상기 비아홀을 포함한 상기 절연층의 일면 상에, 하나 이상의 단위 보조 도전층으로 구성되는 보조 도전층을 형성하는 단계를 포함하는 것을 특징으로 하는 전계 발광 디스플레이 장치 제조 방법을 제공한다.
- <63> 이하, 첨부된 도면을 참조로 본 발명의 바람직한 실시예들에 대하여 보다 상세히 설명한다 .
- <64> 도 1a에는 본 발명의 일실시예에 따른 유기 전계 발광 디스플레이 장치의 평면도가 개략적으로 도시되어 있다. 기관(110)의 일면 상에는 유기 전계 발광 디스플레이 소자와 같은 발광 소자가 배치된 디스플레이 영역(200), 디스플레이 영역(200)의 외측을 따라 도포되어 기관(110)과 봉지 기관(900, 도 2a 참조)을 밀봉시키는 밀봉부(800), 각종 단자들이 배치된 단자

영역(700)을 구비한다. 경우에 따라서는 밀봉부를 통한 밀봉 공정 없이, 디스플레이 영역은 박막 봉지층을 사용하여 밀봉될 수도 있다.

<65> 디스플레이 영역(200)을 구성하는 유기 전계 발광 디스플레이 소자의 구성은 도 1의 선 I-I를 따라 취한 도 2a를 참조하여 설명한다. 기판, 예를 들어 글라스 재의 기판(110) 상에  $\text{SiO}_2$  등으로 버퍼층(120)이 형성된다. 버퍼층(120)의 일면 상에는 반도체 활성층(130)이 형성되는데, 반도체 활성층(130)은 비정질 실리콘층 또는 다결정질 실리콘층으로 형성될 수 있다. 도면에서 자세히 도시되지는 않았으나, 반도체 활성층(130)은 N+형 또는 P+형의 도펀트들로 도핑되는 소스 및 드레인 영역과, 채널 영역으로 구성된다. 반도체 활성층(130)은 유기 반도체로 이루어질 수 있는 등, 상기 사항에 한정되는 것은 아니다.

<66> 반도체 활성층(130)의 일면 상부로 채널 영역에 대응되는 위치에는 게이트 전극(150)이 형성되는데, 게이트 전극(150)에 인가되는 신호 여부에 따라 채널 영역의 통전 여부가 결정되며, 이를 통해 소스 및 드레인 영역이 소통된다. 게이트 전극(150)은 인접층과의 밀착성, 적층되는 층의 표면 평탄성 그리고 가공성 등을 고려하여, 예를 들어 MoW, Al/Cu 등과 같은 물질로 형성되는 것이 바람직하나 이에 한정되는 것은 아니다. 반도체 활성층(130)과 게이트 전극(150)과의 절연성을 확보하기 위하여, 예를 들어, 플라즈마 강화 화학 기상 증착(PECVD)을 통해  $\text{SiO}_2$ 로 구성되는 게이트 절연층(140)이 반도체 활성층(130)과 게이트 전극(150) 사이에 개재된다.

<67> 게이트 전극(150)의 상부에는 중간층(interlayer, 160)이 형성되는데, 중간층은  $\text{SiO}_2$ ,  $\text{SiNx}$  등의 물질로 단층 형성되거나 또는 이중층의 형태로 구성될 수도 있다. 중간층(160)의 상부에는 소스/드레인 전극(170)이 형성된다. 소스/드레인 전극(170)은 중간층(160)과 게이트

절연층(140)에 형성되는 콘택홀을 통하여 반도체 활성층의 소스 영역 및 드레인 영역과 각각 전기적으로 소통된다.

<68> 소스/드레인 전극(170)의 상부에는 하나 이상의 절연층(페시베이션 층 및/또는 평탄화 층, 180)이 형성되어, 하부의 박막 트랜지스터를 보호 및/또는 평탄화시킨다. 본 발명의 일실 시예에 따른 절연층(180)은 BCB(benzocyclobutene) 또는 아크릴(acryl) 등과 같은 유기물을 포함하는 유기물 절연층을 구비하는데, 절연층(180)은 단층 및/또는 복수 층으로 형성될 수도 있고, 경우에 따라서는 SiO<sub>2</sub>, SiN<sub>x</sub> 등과 같은 무기물로 구성되는 무기물 층을 포함할 수도 있다.

<69> 절연층(180)의 일면 상에는 제 1 전극층(210)이 배설되는데, 제 1 전극층의 일단은 절연 층(180)에 형성된 비아홀(181)을 통하여 하부의 드레인 전극(170)과 접촉한다. 제 1 전극층 (210)은 아래에 설명되는 바와 같이, 배면 발광형인 경우, 인듐-틴-옥사이드(ITO) 등의 투명 전극으로 구성될 수 있고, 전면 발광형인 경우, ITO 등의 투명 전극으로 구성되되, 하부에 Al, AlNd, MgAg 등과 같은 재료의 반사층을 구비하는 형태로 구성될 수도 있는 등, 다양한 변형예 를 구비할 수 있다.

<70> 유기 전계 발광부(230)는 저분자 또는 고분자 유기막으로 구성될 수 있는데, 저분자 유기막을 사용할 경우 홀 주입층(HIL: Hole Injection Layer), 홀 수송층(HTL: Hole Transport Layer), 유기 발광층(EML: Emission Layer), 전자 수송층(ETL: Electron Transport Layer), 전자 주입층(EIL: Electron Injection Layer) 등이 단일 혹은 복합의 구조로 적층되어 형성될 수 있으며, 사용 가능한 유기 재료도 구리 프탈로시아닌(CuPc: copper phthalocyanine), N,N-디(나프탈렌-1-일)-N,N'-디페닐-벤지딘 (N,N'-Di(naphthalene-1-yl)-N,N'-diphenyl-benzidine:

NPB), 트리스-8-하이드록시퀴놀린 알루미늄(tris-8-hydroxyquinoline aluminum)(Alq3) 등을 비롯해 다양한 재료를 적용할 수 있다. 이들 저분자 유기막은 진공증착의 방법으로 형성된다.

<71> 고분자 유기막의 경우에는 대개 홀 수송층(HTL) 및 유기 발광층(EML)으로 구비된 구조를 가질 수 있으며, 이 때, 상기 홀 수송층으로 PEDOT를 사용하고, 발광층으로 PPV(Poly-Phenylenevinylene)계 및 폴리플루오렌(Polyfluorene)계 등 고분자 유기물질을 사용하며, 이를 스크린 인쇄나 잉크젯 인쇄방법 등으로 형성할 수 있다.

<72> 유기 전계 발광부(230)의 일면 상부에는 캐소드 전극으로서의 제 2 전극층(400)이 전면 증착되는데, 제 2 전극층(400)은 이러한 전면 증착 형태에 한정되는 것은 아니고, 또한 발광 유형에 따라 Al/Ca, ITO, Mg-Ag 등과 같은 재료로 형성될 수도 있고, 단일층이 아닌 복수의 층으로 형성될 수도 있으며, LiF 등과 같은 알칼리 또는 알칼리 토금속 플루오라이드 층이 더 구비될 수도 있는 등, 다양한 유형으로 구성될 수 있다. 여기서, 본 발명의 설명을 용이하게 하기 위하여 제 1 전극층(210)은 애노드로서, 제 2 전극층(400)은 캐소드로서 기술되었으나, 이에 국한되지 않고 다른 구성을 취할 수도 있다.

<73> 다시, 도 1을 살펴보면, 디스플레이 영역(200)의 외측에는 디스플레이 영역(200)에 구동 전원을 공급하기 위한 구동 전원 공급 라인(300)이 배치된다. 구동 전원 공급 라인(300)은 단자 영역(700)의 구동 전원 공급 단자(320)와 전기적으로 소통된다. 도 1은 본 발명을 설명하기 위한 일례로서, 구동 전원 공급 라인의 배치가 이에 한정되는 것은 아니나, 디스플레이 영역 전체에 걸쳐 균일한 구동 전원을 공급함으로써 휘도 불균일을 개선시킬 수 있다는 점에서, 구동 전원 공급 라인(300)은 디스플레이 영역을 둘러싸도록 형성되는 것이 바람직하다. 구동 전원 공급 라인(300)은 구동 라인(310)과 연결되는데, 구동 라인(310)은 디스플레이 영역

(200)을 가로질러 배치되고 절연층(180) 하부에 배치된 소스 전극(170, 도 2b 참조)과 전기적으로 소통된다.

<74> 또한, 디스플레이 영역(200) 외측에는 수직/수평 구동 회로부(500, 600)가 배치되는데, 이들 수직/수평 구동 회로부(500, 600)는 단자 영역(700)의 수직/수평 구동 단자(520, 620)와 전기적으로 소통된다. 수직 구동 회로부(500)는 디스플레이 영역(200)에 스캔 신호를 인가하는 스캔 구동 회로부가 될 수 있고, 수평 구동 회로부(600)는 디스플레이 영역(200)에 데이터 신호를 인가하는 데이터 구동 회로부가 될 수 있으며, 이들은 경우에 따라서 외장 IC나 COG로 구현될 수도 있다.

<75> 한편, 도 1에 도시된 바와 같이, 디스플레이 영역(200)의 외측을 따라 적어도 일부에는, 디스플레이 영역(200)에 전극 전원을 공급하는 전극 전원 공급 라인(410)이 배치되는데, 전극 전원 공급 라인(410)은 단자 영역(700)의 전극 전원 공급 단자(420)와 전기적으로 소통된다.

<76> 도 2a는 도 1의 선 I-I을 따라 취한 본 발명의 일실시예에 따른 유기 전계 발광 디스플레이 장치의 개략적인 부분 단면도를 도시한다. 도 2a에서, 디스플레이 영역(200) 외측에 배치된 전극 전원 공급 라인(410) 상부에는 하나 이상의 절연층(180)이 연장 형성되어 있고, 연장 형성된 절연층의 일면 상에 보조 도전층(411)을 더 포함한다.

<77> 도 2b 내지 도 2f에는 도 2a에 도시된 본 발명의 일실시예에 따른 유기 전계 발광 디스플레이 장치를 제조 단계를 도시하는 단면도가 도시되어 있다. 먼저, 도 2b에 도시된 바와 같이, 전극 전원 공급 라인(410)은 박막 트랜지스터 층의 소스/드레인 전극(170)과 동시에 형성될 수 있다. 전극 전원 공급 라인(410)이 형성된 후, 전극 전원 공급 라인(410)의 상부에는 유기물 층을 포함하는 하나 이상의 절연층(180)이 형성된다.

- <78> 그런 후, 도 2c에 도시된 바와 같이, 전극 전원 공급 라인(410)과의 전기적 소통을 위한 비아홀(182)을 형성한다. 전극 전원 공급 라인용 비아홀(182)은, 차후 형성되는 화소 전극으로서의 제 1 전극층(210, 도 2e 참조)과 소스/드레인 전극(170)과의 전기적 소통을 위한 비아홀(181)의 형성과 동시에 이루어질 수도 있다.
- <79> 비아홀(182) 형성 후, 도 2e에 도시된 바와 같이, 전극 전원 공급 라인(410)과의 전기적 소통을 위한 비아홀(182)을 포함한, 절연층(180)의 일면 상에는 보조 도전층(411)이 형성된다. 차후에 형성되는 제 2 전극층(400)과 전극 전원 공급 라인(410) 간의 전기적 소통은 이들 사이에 개재되는 보조 도전층(411)을 통하여 이루어진다.
- <80> 전극 전원 공급 라인(410)과 보조 도전층(411) 사이로 비아홀(182)을 제외한 나머지 영역에 절연층(180)이 연장 개재됨으로써, 이들 사이에 절연층(180)이 개재되지 않는 경우 발생할 수 있는, 전극 전원 공급 라인(410) 등의 박리(peeling)를 방지할 수 있다. 또한, 보조 도전층(411)은, 차후 디스플레이 영역(200)에 형성되는 화소 정의층(220, 도 2f 참조), 유기 전계 발광부(230) 등의 형성 과정에서 발생할 수 있는, 노출된 전극 전원 공급 라인(410)의 손상을 방지할 수도 있다.
- <81> 보조 도전층(411)은 디스플레이 영역(200) 제 1 전극층(210)의 적어도 일부와 동일한 층을 구비할 수도 있다. 즉, 보조 도전층(411) 형성은 제 1 전극층(210) 형성과 동시에 이루어질 수 있어, 예를 들어 본 발명에 따른 유기 전계 발광 디스플레이 장치가 Al, AlNd, MgAg 등과 같은 반사물질을 포함하는 반사층을 구비하는 전면 발광형인 경우, 보조 도전층(411)은 ITO 층과 같은 투명 도전층 및/또는 AlNd 등과 같은 반사층을 포함하는 구조를 취할 수도 있다. 제 1 전극층(210)을 구성하는 물질을 비아홀(181, 182)을 포함한 절연층(180) 일면 상에 전면

1020040038735

출력 일자: 2004/9/17

증착시킨 후 적절히 패터닝 공정을 통하여 제 1 전극층(210)을 형성하는 경우, 이와 동시에 보조 전극층(411) 해당 영역도 패터닝화시킴으로써, 보조 전극층(411)을 형성할 수도 있다.

<82> 한편, 보조 전극층(411)으로, 절연층(180) 일면 상에 형성된 부분에는 하나 이상의 관통

부(412)가 형성된다. 도 2e에 도시된 바와 같이, 보조 전극층(411)에 관통부(412)가 형성된

후, 기판(110) 상의 적층부들은 일정 시간 동안 진공 상태에서 어닐링 과정을 거쳐, 차후에 유

기물 층을 포함하는 절연층(180)으로부터 발생 가능한 벤즈알데이드(benzaldehyde),

벤질알코올(benzyl alcohol)과, 벤젠계 화합물 등과 같은 가스들을 사전 배출시킴으로써, 이를

가스에 의한 절연층 손상으로 인하여 절연성이 파괴되는 것을 방지하게 된다. 이와 같이, 절

연층으로부터 발생된 가스를 보조 전극층(411) 내측에 위치된 관통부(412)를 통하여도 배출가

능하게 됨으로써, 절연층으로부터 발생된 가스의 배출 경로는 보조 전극층(411)의 외곽부를 통

하여 배출되는 것으로보다 상당히 단축된 경로를 갖게 된다. 따라서, 진공 어닐링 단계의 공정

시간이 상당히 단축될 수 있다.

<83>

그런 후, 도 2f에 도시된 바와 같이, 디스플레이 영역(200)의 화소를 정의하기 위한 화

소 정의층(220)이, 예를 들어 스퍼터링 및 패터닝 공정을 통하여, 제 1 전극층(210) 상 화소

개구부(240) 및 보조 전극층(411) 상부의 적어도 일부를 제외한 나머지 영역에 형성된다. 화

소 정의층(220)이 형성된 후, 화소 정의층(220)을 포함한 기판(110) 일면 상의 적층부는 진공

상태에서 어닐링되어, 화소 정의층(220)으로부터 차후에 발생될 수 있는 가스를 사전 배출시킨

다. 화소 정의층(220)이 형성된 후, 화소 개구부(240)를 포함한 위치에 유기 전계 발광부

(230) 및 제 2 전극층(400)이 순차적으로 형성된다.

<84>

한편, 도 2a에서, 보조 전극층(411)의 절연층(180) 상부 해당 영역에는 한 개의 관통부

(412)가 형성된 것으로 도시되었으나, 도 3a에 도시된 바와 같이, 보조 전극층(411)에는 둘 이

상의 관통부들(412)이 구비될 수도 있는데, 여기서 점선으로 표시된 비아홀(182)은 도면 상 지면 뒤쪽에 배치된 비아홀(182)을 의미한다. 이 때, 화소의 제 1 전극층(210)은, 그 하부에 위치하는 절연층(180)으로부터 발생하는 가스가 진공 어닐링 단계에서 원활하게 배출될 수 있을 정도의 크기를 구비한다는 점에서, 보조 도전층(411)에 형성된 관통부들(412) 사이의 거리(dp)는, 화소 제 1 전극층(210, 도 6b 참조)의 양단 간 거리 중 최대 거리 이하, 즉, 제 1 전극층(210, 도 6b 참조)의 외곽선을 따른 어느 일지점과 다른 일지점 간의 거리 중 최대 거리 이하인 것이 바람직하다.

<85> 또 한편, 전극 전원 공급 라인 상부에 배치된 절연층의 비아홀은, 그 외측의 적어도 일부에 하나 이상의 관통부를 구비하는 것이 바람직하다. 즉, 도 3b에 도시된 바와 같이, 전극 전원 공급 라인(410) 상부의 절연층(180)에 둘 이상의 비아홀(182)이 형성된 경우, 일부 절연층(180)이 보조 도전층(411)에 의하여 포획될 수 있는데, 절연층(180)의 포획된 부분에서 발생하는 가스가 원활하게 배출될 수 있도록, 비아홀(182) 외측에는 하나 이상의 관통부(412)가 구비되는 것이 바람직하다.

<86> 본 발명에 따라 보조 도전층에 형성되는 관통부는 다양한 형태로 형성될 수 있다. 도 4a 및 도 4b는 도 1의 도면 부호 "A"에 대한 일형태로서의 확대도(절연층 도시 생략)들이 도시되어 있는데, 도 4a에 도시된 바와 같이, 간단한 구조를 원하는 경우, 보조 도전층(411)에는 관통부로서의 관통공(412a)이 형성될 수 있고, 절연층으로부터의 보다 원활한 가스 배출이 요구되는 경우 도 4b에 도시된 바와 같이, 관통부는 수 개의 직선으로 형성된 라인 타입 관통부(412b)로 형성될 수도 있다. 이 경우에도, 비아홀(182) 외측의 적어도 일부에는 하나 이상의 관통부(412a,b)가 형성되는 것이 바람직하고, 관통부(412a,b) 간의 거리는 화소 제 1 전극층의 양단 간 거리 중 최대 거리 이하인 것이 바람직하다.

<87> 한편, 도 1b 내지 도 3b에 도시된 상기 실시예들에서, 전극 전원 공급 라인(410)으로 소스/드레인 전극(170)과 동일층을 사용하는 경우에 대하여 도시 및 기술되었으나, 본 발명이 이에 국한되는 것은 아니다. 즉, 도 5에 도시된 바와 같이, 전극 전원 공급 라인의 보다 원활한 도전성을 확보하기 위하여 전극 전원 공급 라인에 디스플레이 영역의 제 1 전극층(210) 하부에 배치되는 박막 트랜지스터 층의 소스/드레인 전극(170)과 동일한 층(410a) 이외 반도체 활성층(130)과 동일한 층(410b)을 포함할 수도 있거나, 또는 전극 전원 공급 라인으로서 반도체 활성층(130)과 동일한 층(131)만을 구비할 수도 있는 등, 다양한 변형이 가능하다.

<88> 본 발명의 또 다른 일실시예에 따르면, 보조 도전층은 서로 이격된 하나 이상의 단위 보조 도전층으로 구성될 수도 있다. 도 6a는 도 1a의 도면 부호 "A" 부분에 대한 또 다른 형태를 확대 도시한 것으로서, 보조 도전층(411')은, 비아홀(182)을 포함한 절연층(180)의 상부에 형성된 하나 이상의 단위 보조 도전층(411'a)들로 형성될 수 있다. 이러한 단위 보조 도전층(411'a) 들로 구성되는 보조 도전층(411')은 별도의 공정 필요없이, 제 1 전극층(210)의 패터닝 공정시 제 1 전극층(210)과 함께 형성될 수도 있는데, 이들 단위 보조 도전층(411'a)들은 서로 일정 거리(da)만큼 이격 형성됨으로써, 진공 어닐링 단계시 하부 절연층(180)에서 발생하는 가스를 보다 원활하게 보다 빠른 시간 내에 배출시킬 수 있다.

<89> 한편, 단위 보조 도전층(411'a) 하부 절연층(180)으로부터 가스 배출이 원활하게 이루어질 수 있도록, 단위 보조 도전층(411'a)은 일정값 이하의 크기를 구비하는 것이 바람직하다. 도 6b는 도 1a의 도면 부호 "B"로 지칭된, 디스플레이 영역의 일화소에 대한 개략도로, 제 1 박막 트랜지스터(TFT1)는 스캔 라인으로부터의 신호에 따라 화소의 선택 여부를 결정하는 박막 트랜지스터이고, 제 2 박막 트랜지스터(TFT2)는 커패시터(131, 151, 171)를 통한 전기적 신호를 따라 제 1 전극층(210)에 전류를 공급하여 화소를 구동시키는 박막 트랜지스터이다. 여기

서, 두 개의 틈 게이트형 박막 트랜지스터 및 다중 커패시터로 구성된 구조가 도시되었는데, 이는 본 발명의 설명을 위한 일예일뿐 본 발명이 이에 국한되지는 않는다.

<90> 진공 어닐링 단계시, 제 1 전극층(210) 하부 절연층(180)으로부터 가스는 원활하게 배출된다는 점에서, 본 발명에 따른 단위 보조 도전층(411')의 일지점과 인접 외곽 지점 사이의 거리는, 제 1 전극층(210)의 어느 일지점(Pa)과 인접 외곽 지점(Pb) 사이의 거리(dab) 중 최대 거리 이하인 것이 바람직하다.

<91> 상기한 실시예들은 본 발명을 설명하기 위한 일예들로서, 본 발명이 이에 한정되지는 않는다. 즉, 비아홀을 포함한 절연층 일면 상에 형성된 보조 도전층에 구비되는 관통부를 포함하는 사상의 범위에서 다양하게 변형될 수 있다. 또한 상기한 실시예들은 유기 전계 발광 디스플레이 장치에 대하여 기술하였으나, 본 발명의 범위 내에서 무기 전계 발광 디스플레이 장치에도 충분히 적용될 수 있는 등, 다양한 변형예를 고려할 수 있다.

#### 【발명의 효과】

<92> 상기한 바와 같은 본 발명에 따르면, 전극 전원 공급 라인과 제 2 전극층 사이에 절연층이 개재됨으로써 전극 전원 공급 라인의 박리를 방지함과 동시에, 전극 전원 공급 라인과 제 2 전극층 사이에 형성된 보조 도전층은 관통부를 구비함으로써, 전극 전원 공급 라인의 손상 및 박리를 방지함과 동시에, 차후 실시되는 진공 어닐링 단계시 발생 가능한 하부 유기 절연층으로부터의 가스를 원활하게 배출시켜 공정 시간을 단축에 의한 공정 단가를 상당히 저감시킬 수 있다.

<93> 또한, 본 발명에 따른 보조 도전층의 관통부는 비아홀 외측의 적어도 일부에 배치됨으로써 및/또는 관통부 사이 거리를 일정하게 유지함으로써, 보조 도전층 하부 절연층에서 생성된

가스가 보조 도전층에 의하여 포획되지 않고, 신속 및 원활하게 배출될 수 있도록 할 수도 있다.

<94> 또한, 본 발명에 따른 보조 도전층은, 서로 이격되고 화소 제 1 전극층 이하의 크기를 갖는 단위 보조 도전층으로 형성됨으로써, 하부 절연층에서 생성되는 가스를 보다 신속 원활하게 외부로 배출시킬 수 있다.

<95> 또한, 본 발명에 따른 전극 전원 공급 라인은 하나 이상의 도전층을 구비함으로써 보다 원활한 도전성을 확보할 수도 있다.

<96> 본 발명은 첨부된 도면에 도시된 일 실시예를 참고로 설명되었으나 이는 예시적인 것에 불과하며, 당해 기술분야에서 통상의 지식을 가진 자라면 이로부터 다양한 변형 및 균등한 타 실시예가 가능하다는 점을 이해할 수 있을 것이다. 따라서 본 발명의 진정한 보호 범위는 첨부된 청구 범위에 의해서만 정해져야 할 것이다.

**【특허청구범위】****【청구항 1】**

기판 일면 상부의, 하나 이상의 층을 갖는 제 1 전극층 및 제 2 전극층, 그리고 이들 사이에 형성된 전계 발광부를 갖는 화소들을 구비하는 디스플레이 영역과,

상기 디스플레이 영역에 전극 전원을 공급하는 전극 전원 공급 라인을 포함하는 전계 발광 디스플레이 장치에 있어서,

상기 전극 전원 공급 라인 상부에 배치되고, 하나 이상의 비아홀을 구비하며, 유기물을 포함하는 하나 이상의 절연층과;

상기 전극 전원 공급 라인을 따라, 상기 비아홀을 포함한, 상기 절연층의 일면 상에 형성되는 보조 도전층;을 더 포함하고,

상기 전극 전원 공급 라인과 상기 제 2 전극층 사이의 전기적 소통은 상기 비아홀에서 상기 보조 도전층을 통하여 이루어지되, 상기 절연층 일면 상의 보조 도전층에는 하나 이상의 관통부가 구비되는 것을 특징으로 하는 전계 발광 디스플레이 장치.

**【청구항 2】**

제 1 항에 있어서,

상기 보조 도전층은 상기 제 1 전극층의 적어도 일부와 동일층인 것을 특징으로 하는 전계 발광 디스플레이 장치.

**【청구항 3】**

제 1 항에 있어서,

상기 보조 도전층에는 둘 이상의 관통부들이 구비되고,

상기 관통부들 사이의 거리는, 상기 화소 제 1 전극층 양단 간 거리중 최대 거리 이하인 것을 특징으로 하는 전계 발광 디스플레이 장치.

**【청구항 4】**

제 3항에 있어서,

상기 비아홀 외측의 적어도 일부에는 하나 이상의 관통부가 구비되는 것을 특징으로 하는 전계 발광 디스플레이 장치.

**【청구항 5】**

제 1항 내지 제 4항 중의 어느 한 항에 있어서,

상기 관통부는 하나 이상의 관통공을 포함하는 것을 특징으로 하는 전계 발광 디스플레이 장치.

**【청구항 6】**

제 1항 내지 제 4항 중의 어느 한 항에 있어서,

상기 관통부는 라인 타입 관통부를 포함하는 것을 특징으로 하는 전계 발광 디스플레이 장치.

**【청구항 7】**

제 1항 내지 제 4항 중의 어느 한 항에 있어서,

상기 제 1 전극층 하부에는 박막 트랜지스터 층을 구비하고,

상기 전극 전원 공급 라인에는 상기 박막 트랜지스터 층의 소스/드레인 전극과 동일층을 포함하는 것을 특징으로 하는 전계 발광 디스플레이 장치.

제 9항에 있어서,

【청구항 10】

격되어 있는 것을 특징으로 하는 전계 발광 디스플레이 장치.

상기 보조 도전층을 통하여 이루어지되, 상기 절연층 일면 상의 단위 보조 도전층들은 서로 이

상기 전극 전원 공급 라인과 상기 제 2 전극층 사이의 전기적 소용은 상기 비아홀에서

형되는 하나 이상의 단위 보조 도전층으로 구성되는 보조 도전층;를 더 포함하고,

상기 전극 전원 공급 라인을 따라, 상기 비아홀을 포함한, 상기 절연층의 일면 상에 형

포함하는 하나 이상의 절연층과;

상기 전극 전원 공급 라인 상부에 배치되고, 하나 이상의 비아홀을 구비하며, 유기물을

발광 디스플레이 장치에 있어서,

상기 디스플레이 영역에 전극 전원층을 공급하는 전극 전원 공급 라인을 포함하는 전계

이에 형성된 전계 발광부를 갖는 화소들을 구비하는 디스플레이 영역과,

기판 일면 상부의, 하나 이상의 층을 갖는 제 1 전극층 및 제 2 전극층, 그리고 이를 사

【청구항 9】

함하는 것을 특징으로 하는 전계 발광 디스플레이 장치.

상기 전극 전원 공급 라인에는 상기 박막 트랜지스터 층의 반도체 활성층과 동일층을 포

상기 제 1 전극층 하부에는 박막 트랜지스터 층을 구비하고,

제 1항 내지 제 4항 중의 어느 한 항에 있어서,

【청구항 8】

1020040038735

출력 일자: 2004/9/17

제 11항에 있어서,

【청구항 13】

과 동시에 실시되는 것을 특징으로 하는 전계 발광 디스플레이 장치 제조 방법.  
상기 보조 도전을 형성 단계는, 상기 하나 이상의 제 1 전극층의 적어도 일부를 형성함

제 11항에 있어서,

【청구항 12】

로 하는 전계 발광 디스플레이 장치 제조 방법.  
상기 절연을 일면 상의 보조 도전에 관동부를 형성하는 단계를 포함하는 것을 특징으로  
상기 비아홀을 포함한 상기 절연층의 일면 상에 보조 도전을 형성하는 단계;  
상기 하나 이상의 절연층에 하나 이상의 비아홀을 형성하는 단계;

계;

상기 전극 전원 공급 라인 상부에 유기물을 포함하는 하나 이상의 절연층을 형성하는 단  
발광 디스플레이 장치를 제조하는 방법에 있어서,  
상기 디스플레이 영역에 전극 전원을 공급하는 전극 전원 공급 라인을 포함하는 전계  
이에 형성된 전계 발광부를 갖는 화소들을 구비하는 디스플레이 영역과,  
기판 일면 상부의, 하나 이상의 층을 갖는 제 1 전극층 및 제 2 전극층, 그리고 이를 사

【청구항 11】

지.

일지점 및 인접 외곽부 사이 최대 거리 이하인 것을 특징으로 하는 전계 발광 디스플레이 장  
상기 단위 보조 도전을 일지점 및 인접 외곽부 사이의 거리는, 상기 화소 제 1 전극층

1020040038735

출력 일자: 2004/9/17

상기 비아홀 형성 단계시, 둘 이상의 비아홀이 형성되고,

상기 관통부 형성 단계시, 상기 관통부는 적어도 상기 비아홀들 사이에 형성되는 것을 특징으로 하는 전계 발광 디스플레이 장치 제조 방법.

【청구항 14】

제 11항에 있어서,

상기 관통부 형성 단계시, 둘 이상의 관통부를 형성하되, 상기 관통부 사이의 거리는, 상기 화소 제 1 전극층 양단 간의 최대 거리 이하이도록 형성하는 것을 특징으로 하는 전계 발광 디스플레이 장치 제조 방법.

【청구항 15】

기판 일면 상부의, 하나 이상의 층을 갖는 제 1 전극층 및 제 2 전극층, 그리고 이들 사이에 형성된 전계 발광부를 갖는 화소들을 구비하는 디스플레이 영역과,

상기 디스플레이 영역에 전극 전원을 공급하는 전극 전원 공급 라인을 포함하는 전계 발광 디스플레이 장치를 제조하는 방법에 있어서,

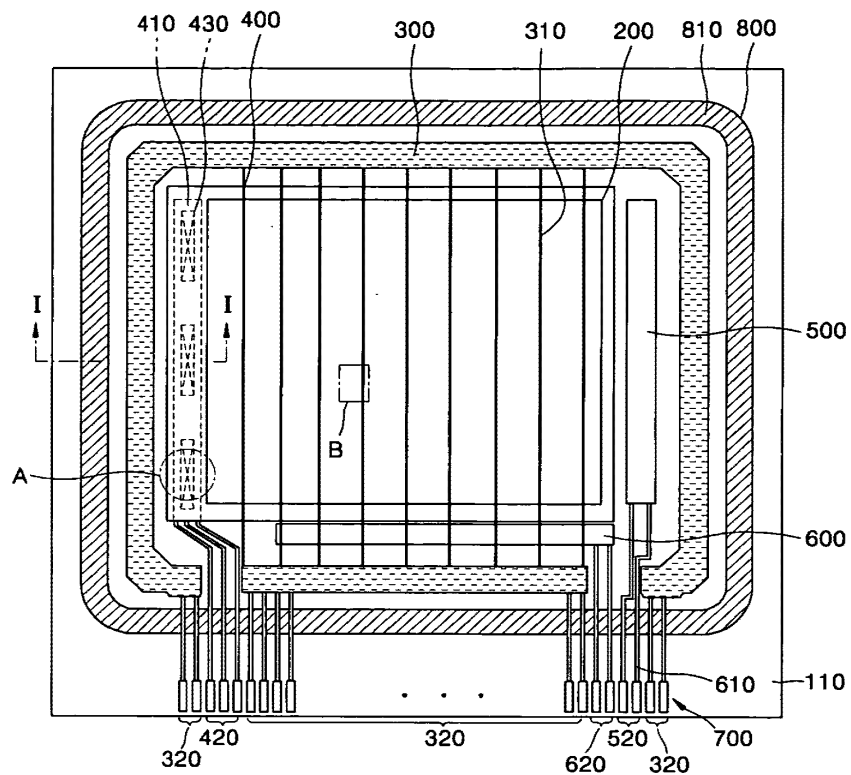
상기 전극 전원 공급 라인 상부에 유기물을 포함하는 하나 이상의 절연층을 형성하는 단계;

상기 하나 이상의 절연층에 하나 이상의 비아홀을 형성하는 단계;

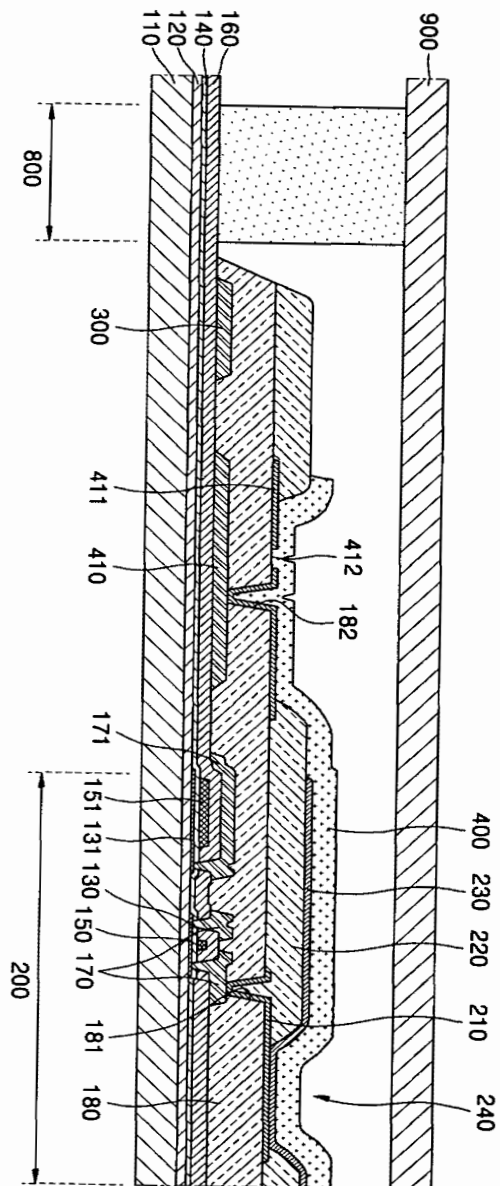
상기 비아홀을 포함한 상기 절연층의 일면 상에, 하나 이상의 단위 보조 도전층으로 구성되는 보조 도전층을 형성하는 단계를 포함하는 것을 특징으로 하는 전계 발광 디스플레이 장치 제조 방법.

【도면】

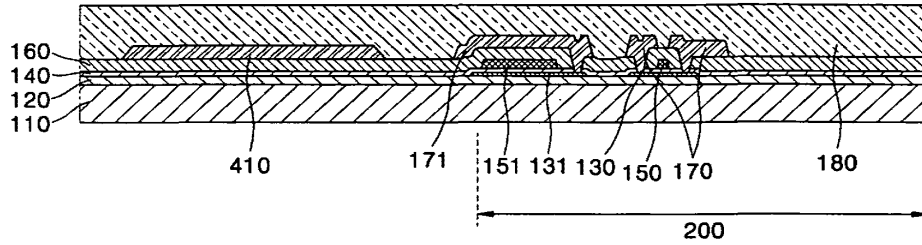
【도 1a】



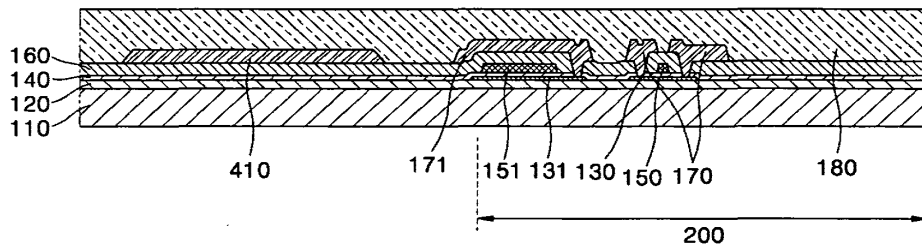
【도 2a】



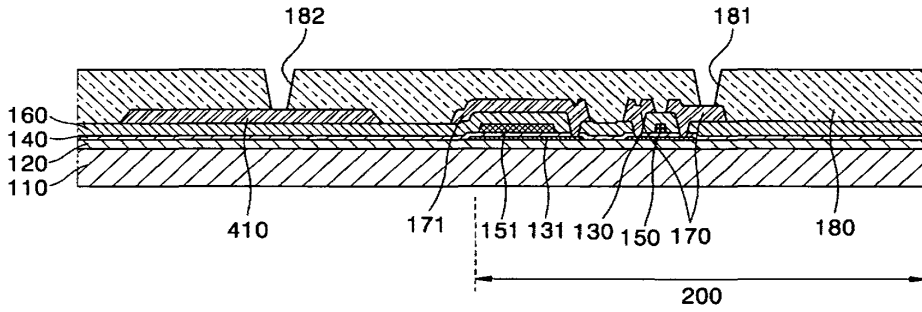
【도 2b】



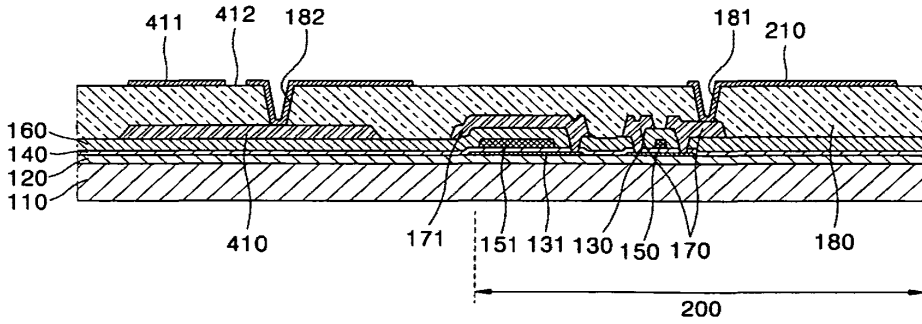
【도 2c】



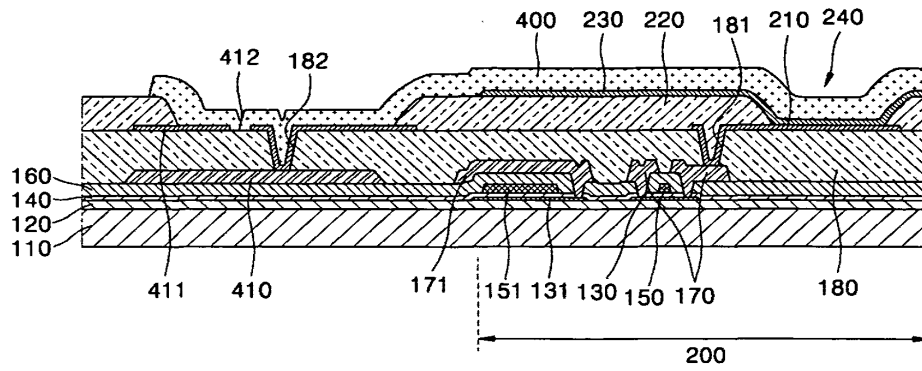
【도 2d】



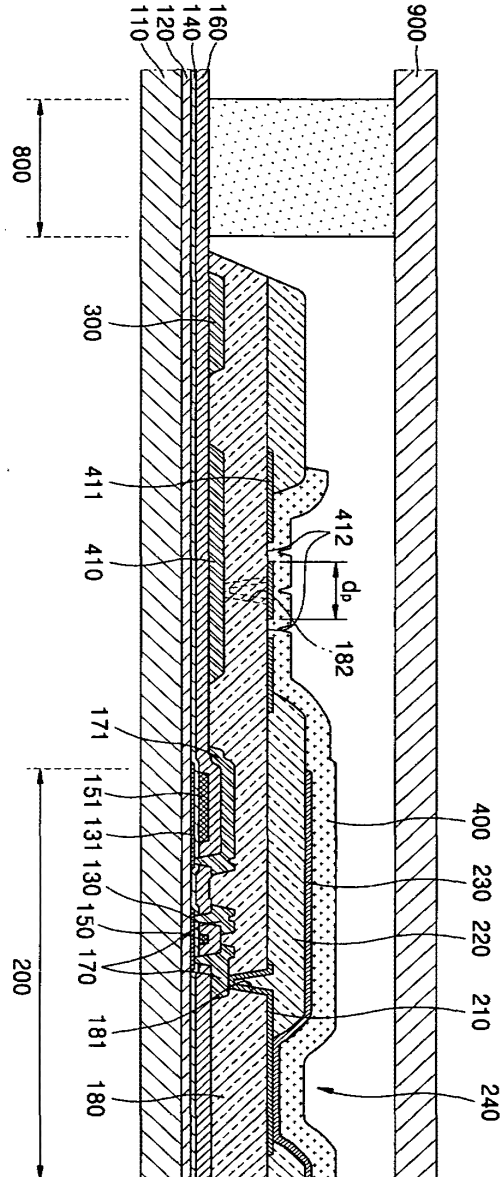
【도 2e】



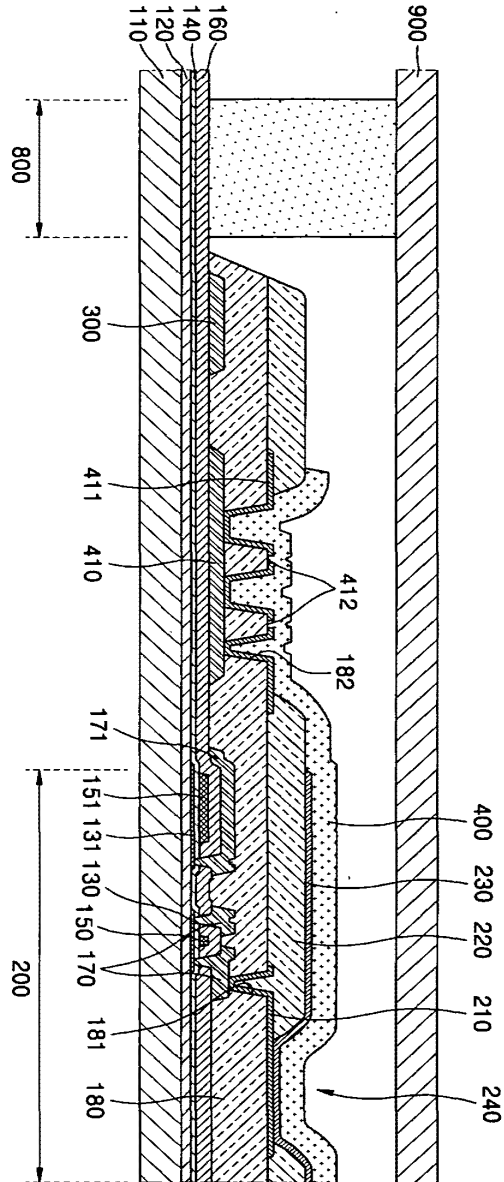
【도 2f】



【도 3a】



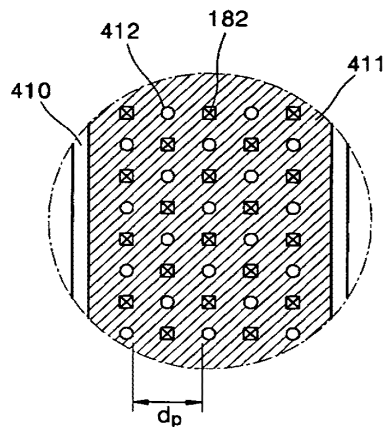
【도 3b】



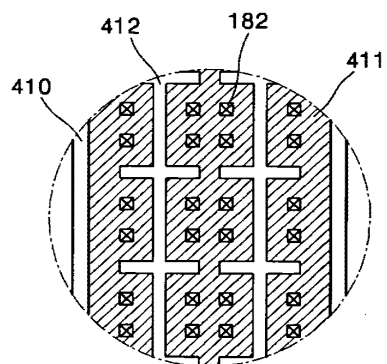
1020040038735

출력 일자: 2004/9/17

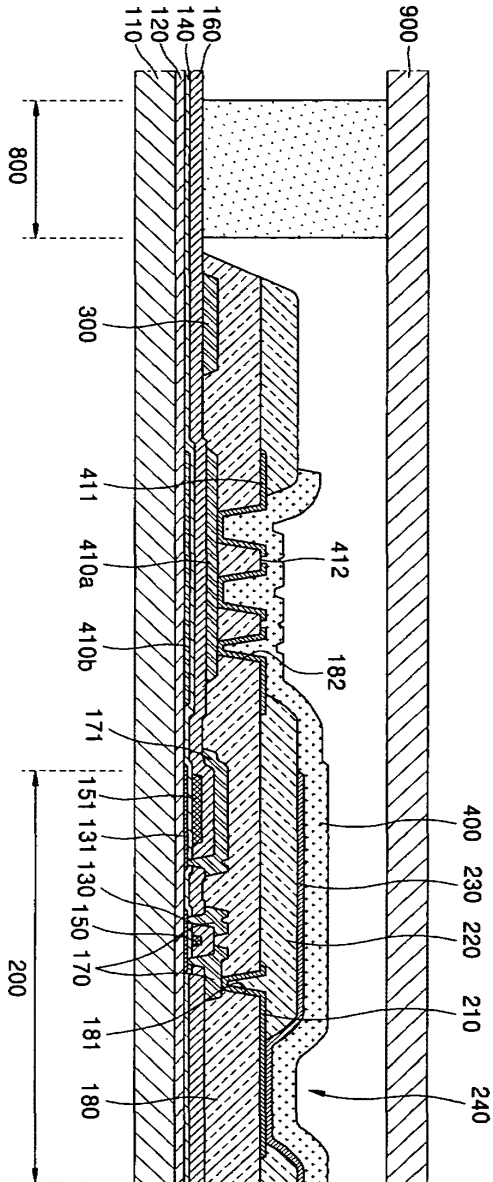
【도 4a】



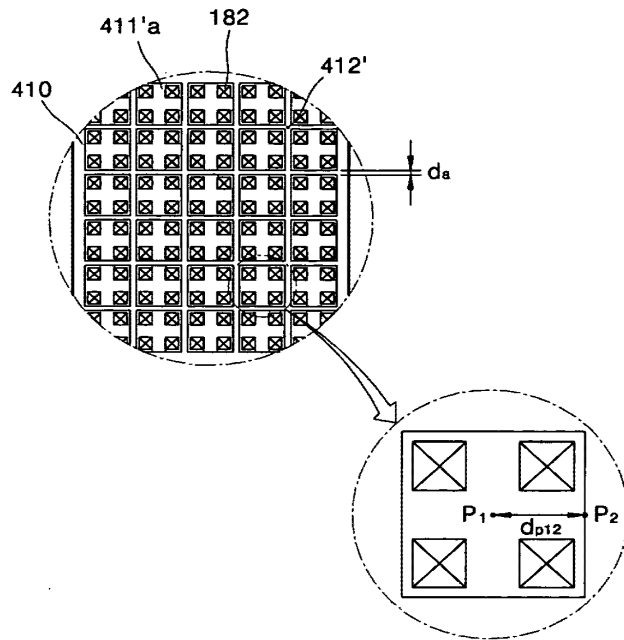
【도 4b】



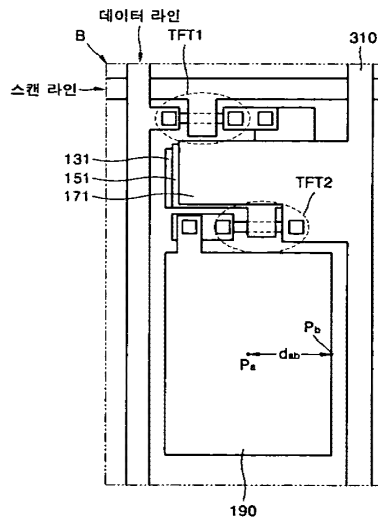
【도 5】



【도 6a】



【도 6b】



Inw: Won-Kyo Kwak et al  
Atty Dkt: 6161.0533. US

5

11/29/48 U.S. PTO

**UTILITY PATENT APPLICATION TRANSMITTAL  
(Large Entity)**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.  
6161.0533.US

Total Pages in this Submission

**COMMISSIONER FOR PATENTS**P.O. Box 1450  
Alexandria, VA 22313-1450

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

**ELECTROLUMINESCENCE DISPLAY DEVICE AND METHOD OF MANUFACTURING THE SAME**

and invented by:

**Won-Kyu KWAK; Kwan-Hee LEE; Seung-Yong SONG**11/29/48 U.S. PTO  
11/138323  
052705If a **CONTINUATION APPLICATION**, check appropriate box and supply the requisite information:☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: \_\_\_\_\_

Which is a:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: \_\_\_\_\_

Which is a:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: \_\_\_\_\_

Enclosed are:

**Application Elements**

1. ☒ Filing fee as calculated and transmitted as described below
2. ☒ Specification having 21 pages and including the following:
  - a. ☒ Descriptive Title of the Invention
  - b. ☒ Cross References to Related Applications (if applicable)
  - c. ☐ Statement Regarding Federally-sponsored Research/Development (if applicable)
  - d. ☐ Reference to Sequence Listing, a Table, or a Computer Program Listing Appendix
  - e. ☒ Background of the Invention
  - f. ☒ Brief Summary of the Invention
  - g. ☒ Brief Description of the Drawings (if filed)
  - h. ☒ Detailed Description
  - i. ☒ Claim(s) as Classified Below
  - j. ☒ Abstract of the Disclosure

1669  
U.S. PTO**UTILITY PATENT APPLICATION TRANSMITTAL  
(Large Entity)**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.  
6161.0533.US

Total Pages in this Submission

**Fee Calculation and Transmittal**

| CLAIMS AS FILED                                                          |        |                      |                           |      |          |            |
|--------------------------------------------------------------------------|--------|----------------------|---------------------------|------|----------|------------|
| For                                                                      | #Filed | #Allowed             | #Extra                    | Rate |          | Fee        |
| Total Claims                                                             | 15     | - 20 =               | 0                         | x    | \$50.00  | \$0.00     |
| Indep. Claims                                                            | 4      | - 3 =                | 1                         | x    | \$200.00 | \$200.00   |
| Multiple Dependent Claims (check if applicable) <input type="checkbox"/> |        |                      |                           |      |          | \$0.00     |
| Total # of Pages in Specification                                        |        | 21                   | Total # of Drawing Sheets |      | 10       |            |
| Total # of Sheets                                                        | 31     | Application Size Fee |                           |      |          | \$0.00     |
| Basic Fee                                                                |        |                      |                           |      |          | \$300.00   |
| Search Fee                                                               |        |                      |                           |      |          | \$500.00   |
| Examination Fee                                                          |        |                      |                           |      |          | \$200.00   |
| OTHER FEE (specify purpose)                                              |        |                      |                           |      |          | \$0.00     |
| TOTAL FILING FEE                                                         |        |                      |                           |      |          | \$1,200.00 |

- ☒ A check in the amount of \$1,200.00 to cover the filing fee is enclosed.
- ☒ The Director is hereby authorized to charge and credit Deposit Account No. 23-1951 as described below.
- ☐ Charge the amount of \_\_\_\_\_ as filing fee.
- ☒ Credit any overpayment.
- ☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
- ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

☐ Payment by credit card. Form PTO-2038 is attached.

**WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.**



Signature

Dated: 27 May 2005

Customer Number: 23345

cc: HCP:PCF/tmf

Hae-Chan Park  
Registration No. 50,114  
McGuireWoods LLP  
1750 Tysons Boulevard, Suite 1800  
McLean, Virginia 22102  
Telephone: 703-712-5365  
Facsimile: 703-712-5280