



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	ATTY. DOCKET NO./TITLE
61/841,360	06/30/2013	Arokia Nathan	

Arokia Nathan
189 Huntingdon Road
Cambridge, CB3 0DL
UNITED KINGDOM

CONFIRMATION NO. 3603
ABANDONMENT/TERMINATION
LETTER



Date Mailed: 03/28/2014

NOTICE OF ABANDONMENT UNDER 37 CFR 1.53 (f) OR (g)

The above-identified application is abandoned for failure to timely or properly reply to the Notice to File Missing Parts (Notice) mailed on 07/15/2013.

- The reply received on 10/17/2013 was untimely.

If a complete reply to the notice was previously filed by applicant within the time period set forth in the notice, applicant may request for reconsideration of the holding of abandonment within 2 months from the mailing of this notice of abandonment by filing a petition to withdraw the holding of abandonment under 37 CFR 1.181(a). No petition fee is required. The petition must be accompanied by a true copy of the originally filed reply and the item(s) identified in one of the following:

1. A properly itemized date-stamped postcard receipt (see MPEP § 503);
2. If the originally filed reply included a certificate of mailing or transmission in compliance with 37 CFR 1.8(a), a copy of the certificate of mailing or transmission and a statement in compliance with 37 CFR 1.8(b) (see MPEP § 512); or
3. If the reply was filed via "Express Mail", (now "Priority Mail Express"), a submission satisfying the requirements of 37 CFR 1.10(e) including, for example, a copy of the mailing label showing the "date-in" (or "date accepted") (see MPEP § 513).

If applicant did not previously file complete reply within the the time period set forth in the notice, applicant may file a petition to revive the application under 37 CFR 1.137.

Under 37 CFR 1.137, a petition requesting that the application be revived on the grounds of UNINTENTIONAL DELAY must be filed promptly after applicant becomes aware of the abandonment and such petition must be accompanied by: (1) the reply required to the outstanding Office action or notice, unless previously filed; (2) the petition fee set forth in 37 CFR 1.17(m); (3) a terminal disclaimer (and fee set forth in 37 CFR 1.20(d)) if required by 37 CFR 1.137(d); and (4) a statement that the entire delay in filing the required reply from the due date for the reply until the filing of a grantable petition was unintentional. See MPEP 711.03(c) and Form PTO/SB/64.

Any questions concerning petitions to revive should be directed to the Office of Petitions at (571) 272-3282. Petitions should be mailed to Mail Stop Petitions, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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

/ylueng/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Electronic Acknowledgement Receipt	
EFS ID:	16197278
Application Number:	61841360
International Application Number:	
Confirmation Number:	3603
Title of Invention:	Dry Transfer of Oxide CVD Graphene Stacks via Anodic Bonding
First Named Inventor/Applicant Name:	Arokia Nathan
Correspondence Address:	Arokia Nathan - 189 Huntingdon Road - Cambridge CB3 0DL GB 44-1223-279135 an299@cam.ac.uk
Filer:	Arokia Nathan
Filer Authorized By:	
Attorney Docket Number:	
Receipt Date:	30-JUN-2013
Filing Date:	
Time Stamp:	08:07:40 10/17/2013 APEREZAM 00000004 61841360
Application Type:	Provisional 01 FC:2052 30.00 0P

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$260



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
61/841,360	06/30/2013	Arokia Nathan	

Arokia Nathan
189 Huntingdon Road
Cambridge, CB3 0DL
UNITED KINGDOM

CONFIRMATION NO. 3603
FORMALITIES LETTER



OC000000063967527

Date Mailed: 09/25/2013

NOTICE OF INCOMPLETE REPLY (PROVISIONAL)

Filing Date Granted

The U.S. Patent and Trademark Office has received your reply on 09/11/2013 to the Notice to File Missing Parts (Notice) mailed 07/15/2013 and it has been entered into the provisional application. The reply, however, does not include the following items required in the Notice.

The period of reply remains as set forth in the Notice. You may, however, obtain EXTENSIONS OF TIME under the provisions of 37 CFR 1.136 (a) accompanied by the appropriate fee (37 CFR 1.17(a)).

A complete reply must be timely filed to prevent ABANDONMENT of the above-identified application.

Items Required to Avoid Abandonment:

The required items noted below SHOULD be filed along with any items required above. The filing date of this nonprovisional application will be the date of receipt of the items required above.

- Surcharge (for late submission of filing fee or cover sheet) as set forth in 37 CFR 1.16(g) of \$ 30 was not received.

The applicant needs to satisfy supplemental fees problems indicated below.

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

SUMMARY OF FEES DUE:

Total fee(s) required within **TWO MONTHS** from the date of the Notice is \$ **30** for a small entity

- \$ **30** Surcharge.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

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

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.

<https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/fasrat/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO.	TOT CLAIMS	IND CLAIMS
61/841,360	06/30/2013		260			

CONFIRMATION NO. 3603

FILING RECEIPT



OC000000063967528

Arokia Nathan
189 Huntingdon Road
Cambridge, CB3 0DL
UNITED KINGDOM

Date Mailed: 09/25/2013

Receipt is acknowledged of this provisional patent application. It will not be examined for patentability and will become abandoned not later than twelve months after its filing date. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Arokia Nathan, Cambridge, UNITED KINGDOM;

Applicant(s)

Arokia Nathan, Cambridge, UNITED KINGDOM;

Power of Attorney: None

If Required, Foreign Filing License Granted: 07/12/2013

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 61/841,360**

Projected Publication Date: None, application is not eligible for pre-grant publication

Non-Publication Request: No

Early Publication Request: No

** SMALL ENTITY **

Title

Dry Transfer of Oxide CVD Graphene Stacks via Anodic Bonding

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same

page 1 of 3

effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with

respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
61/841,360	06/30/2013	Arokia Nathan	

Arokia Nathan
189 Huntingdon Road
Cambridge, CB3 0DL
UNITED KINGDOM



CONFIRMATION NO. 3603
FORMALITIES LETTER



OC000000062536002

Date Mailed: 07/15/2013

NOTICE TO FILE MISSING PARTS OF PROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(c)

Filing Date Granted

An application number and filing date have been accorded to this provisional application. The items 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 provisional application cover sheet under 37 CFR 1.51(c)(1), which may be an application data sheet (37 CFR 1.76), is required identifying:
 - either city and state, or city and foreign country, of the residence of each inventor.

The applicant needs to satisfy supplemental fees problems indicated below.

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

- A surcharge (for late submission of filing fee or cover sheet) as set forth in 37 CFR 1.16(g) of \$ 60 for an undiscounted entity, must be submitted.

SUMMARY OF FEES DUE:

Total fee(s) required within **TWO MONTHS** from the date of this Notice is \$ 60 for an undiscounted entity

- \$ 60 Surcharge.

~~1) Pay \$60.~~
2) Cambridge, UK

Serial No:

1) 1266747880

2) 1267908375

(9th Sept 2013).

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

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

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.

<https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/ddkitila/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

page 2 of 2

A handwritten signature in black ink, appearing to read "M. Watson", is written over the "page 2 of 2" text.



PTO/SB/16 (03-13)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET – Page 1 of 2

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. _____

INVENTOR(S)		
Given Name (first and middle (if any))	Family Name or Surname	Residence (City and either State or Foreign Country)
ARONIA	NATHAN	CAMBRIDGE, MA
Additional inventors are being named on the <u>0</u> separately numbered sheets attached hereto.		
TITLE OF THE INVENTION (500 characters max):		
DRY TRANSFER OF OXIDE CVD GRAPHENE STACKS VIA ANODE BONDING		
Direct all correspondence to: CORRESPONDENCE ADDRESS		
☒ The address corresponding to Customer Number: 189 HUNTINGDON ROAD, CAMBRIDGE, MA		
OR		
☐ Firm or Individual Name		
Address		
City	State	Zip
Country	Telephone	Email
ENCLOSED APPLICATION PARTS (check all that apply)		
☒ Application Data Sheet. See 37 CFR 1.76.		
☐ Drawing(s) Number of Sheets _____		
☐ Specification (e.g., description of the invention) Number of Pages _____		
☐ CD(s), Number of CDs _____		
☐ Other (specify) _____		
Fees Due: Filing Fee of \$260 (\$130 for small entity) (\$65 for micro entity). If the specification and drawings exceed 100 sheets of paper, an application size fee is also due, which is \$400 (\$200 for small entity) (\$100 for micro entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).		
METHOD OF PAYMENT OF THE FILING FEE AND APPLICATION SIZE FEE FOR THIS PROVISIONAL APPLICATION FOR PATENT		
☒ Applicant asserts small entity status. See 37 CFR 1.27.		
☐ Applicant certifies micro entity status. See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.		
☐ A check or money order made payable to the Director of the United States Patent and Trademark Office is enclosed to cover the filing fee and application size fee (if applicable).		
☐ Payment by credit card. Form PTO-2038 is attached.		
☒ The Director is hereby authorized to charge the filing fee and application size fee (if applicable) or credit any overpayment to Deposit		
Account Number: <u>4500 6001 0906 3259</u>		
TOTAL FEE AMOUNT (\$)		

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

This collection of information is required by 37 CFR 1.51. 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 10 hours 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.

Nathan

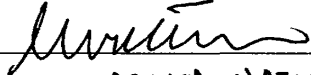
Under the Paperwork Reduction Act of 1995 no persons are required to respond to a collection of information unless it displays a valid OMB control number

PROVISIONAL APPLICATION FOR PATENT COVER SHEET – Page 2 of 2

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.☐ Yes, the invention was made by an agency of the U.S. Government. The U.S. Government agency name is: _____☐ Yes, the invention was made under a contract with an agency of the U.S. Government. The name of the U.S. Government agency and Government contract number are: _____**WARNING:**

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

SIGNATURE  DATE 9th SEPT 2013
 TYPED OR PRINTED NAME AZUMIA NATHAN REGISTRATION NO. /
 (if appropriate)
 TELEPHONE +44 (0) 1223 748302 DOCKET NUMBER /



Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



PTO/SB/92 (07-09)
Approved for use through 07/31/2012. OMB 0561-0031
Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Certificate of Mailing under 37 CFR 1.8

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

on 9TH SEPTEMBER 2013
Date

W Nathan

Signature

AROKIA NATHAN

Typed or printed name of person signing Certificate

61/841,360

Registration Number, if applicable

+44(0)1223 748302

Telephone Number

Note: Each paper must have its own certificate of mailing, or this certificate must identify each submitted paper.

W Nathan 1) APPLICATION DATA SHEET 37 CFR 1.76

W Nathan 2) PROVISIONAL APPLICATION FOR PATENT COVER SHEET 37 CFR 1.53(c)

This collection of information is required by 37 CFR 1.8. 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 1.8 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.



Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	
		Application Number	61/341,360
Title of Invention	Dry Transfer of Oxide CVD Graphene Stacks Via Anodic Bonding		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2

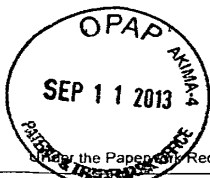
☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
Dr.	Arokia		Nathan		
Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service					
City	Cambridge	Country of Residence ⁱ	UK		
Mailing Address of Inventor:					
Address 1		189 Huntingdon Road			
Address 2					
City	Cambridge	State/Province			
Postal Code	CB30DL	Country ⁱ	UK		
Inventor 2					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
Dr.	Matthew	Thomas	Cole		
Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service					
City	Cambridge	Country of Residence ⁱ	UK		
Mailing Address of Inventor:					
Address 1		St Edmund's College			
Address 2		Mount Pleasant			
City	Cambridge	State/Province			
Postal Code	CB30BN	Country ⁱ	UK		
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.					
					Add

Correspondence Information:

EFS Web 2.2.8



PTO/AIA/14 (03-13)

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U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	
		Application Number	61/841,360
Title of Invention	Dry Transfer of Oxide CVD Graphene Stacks Via Anodic Bonding		

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☒ An Address is being provided for the correspondence information of this application.

Name 1	Arokia Nathan	Name 2	
Address 1	189 Huntingdon Road		
Address 2			
City	Cambridge	State/Province	
Country	UK	Postal Code	CB30DL
Phone Number	+44(0)1223 748302	Fax Number	
Email Address	an299@cam.ac.uk		Add Email Remove Email

Application Information:

Title of the Invention	Dry Transfer of Oxide CVD Graphene Stacks Via Anodic Bonding		
Attorney Docket Number		Small Entity Status Claimed	☐
Application Type	Provisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)		Suggested Figure for Publication (if any)	

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

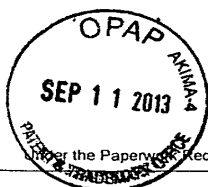
Request Not to Publish. I hereby request that the attached application not be published under

☐ 35 U.S.C. 122(b) and certify that the invention disclosed in the attached 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 at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number			



Application Data Sheet 37 CFR 1.76		Attorney Docket Number	
		Application Number	61/841,360
Title of Invention	Dry Transfer of Oxide CVD Graphene Stacks Via Anodic Bonding		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.			
Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(d). When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) ¹ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(h)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).			
			Remove
Application Number	Country ¹	Filing Date (YYYY-MM-DD)	Access Code (if applicable)
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Authorization to Permit Access:



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

PTO/AIA/14 (03-13)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	
		Application Number	61 / 841, 360
Title of Invention	Dry Transfer of Oxide CVD Graphene Stacks Via Anodic Bonding		

☐ Authorization to Permit Access to the Instant Application by the Participating Offices

If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

☐ Assignee	☐ Legal Representative under 35 U.S.C. 117	☐ Joint Inventor
☐ Person to whom the inventor is obligated to assign.	☐ Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor :

If the Applicant is an Organization check here. ☐

Prefix	Given Name	Middle Name	Family Name	Suffix
Dr.	Arokia		Nathan	



PTO/AIA/14 (03-13)

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U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	
		Application Number	61/341,360
Title of Invention	Dry Transfer of Oxide CVD Graphene Stacks Via Anodic Bonding		

Mailing Address Information For Applicant:			
Address 1		189 Huntingdon Road	
Address 2			
City		Cambridge	State/Province
Country	UK	Postal Code	CB30DL
Phone Number		+44(0)1223 748302	Fax Number
Email Address		an299@cam.ac.uk	
Additional Applicant Data may be generated within this form by selecting the Add button.			

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Assignee 1				
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
If the Assignee is an Organization check here. ☐				
Prefix	Given Name	Middle Name	Family Name	Suffix
Mailing Address Information For Non-Applicant Assignee:				
Address 1				
Address 2				
City			State/Province	
Country		Postal Code		
Phone Number			Fax Number	
Email Address				
Additional Assignee Data may be generated within this form by selecting the Add button.				



PTO/AIA/14 (03-13)

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	
		Application Number	61/341,360
Title of Invention	Dry Transfer of Oxide CVD Graphene Stacks Via Anodic Bonding		

Signature:

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications.					
Signature			Date (YYYY-MM-DD)	2013-08-16	
First Name	Arokia	Last Name	Nathan	Registration Number	
Additional Signature may be generated within this form by selecting the Add button.					

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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.**



Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



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	ATTY. DOCKET NO./TITLE
61/841,360	06/30/2013	Arokia Nathan	

Arokia Nathan
189 Huntingdon Road
Cambridge, CB3 0DL
UNITED KINGDOM

CONFIRMATION NO. 3603
FORMALITIES LETTER



Date Mailed: 07/15/2013

NOTICE TO FILE MISSING PARTS OF PROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(c)

Filing Date Granted

An application number and filing date have been accorded to this provisional application. The items 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 provisional application cover sheet under 37 CFR 1.51(c)(1), which may be an application data sheet (37 CFR 1.76), is required identifying:
 - either city and state, or city and foreign country, of the residence of each inventor.

The applicant needs to satisfy supplemental fees problems indicated below.

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

- A surcharge (for late submission of filing fee or cover sheet) as set forth in 37 CFR 1.16(g) of \$ **60** for an undiscounted entity, must be submitted.

SUMMARY OF FEES DUE:

Total fee(s) required within **TWO MONTHS** from the date of this Notice is \$ **60** for an undiscounted entity

- \$ **60** Surcharge.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

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

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.

<https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/ddkitila/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



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	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO.	TOT CLAIMS	IND CLAIMS
61/841,360	06/30/2013		260			

CONFIRMATION NO. 3603

FILING RECEIPT



OC000000062536001

Arokia Nathan
189 Huntingdon Road
Cambridge, CB3 0DL
UNITED KINGDOM

Date Mailed: 07/15/2013

Receipt is acknowledged of this provisional patent application. It will not be examined for patentability and will become abandoned not later than twelve months after its filing date. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Arokia Nathan, Residence Not Provided;

Applicant(s)

Arokia Nathan, Residence Not Provided;

Power of Attorney: None

If Required, Foreign Filing License Granted: 07/12/2013

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 61/841,360**

Projected Publication Date: None, application is not eligible for pre-grant publication

Non-Publication Request: No

Early Publication Request: No

Title

Dry Transfer of Oxide CVD Graphene Stacks via Anodic Bonding

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing

page 1 of 3

of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of

State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

Dry-Transfer of Oxide/CVD Graphene Stacks *via* Anodic Bonding

Invention Disclosure: *A. Nathan
and M. T. Cole*

14th June 2013

Described herein is a method to transfer oxide coated graphene from the source catalyst layer to arbitrary substrates for subsequent device and circuit integration. The invention will find broad application in the field of electronics and optoelectronics by facilitating the fabrication of high-performing devices such as field effect transistors, antennas and photodetectors. The disclosure combines all the beneficial attributes of large area chemical vapor deposition of graphene and oxide materials whilst removing the need for costly and property-degrading wet-chemical etching and processing of the underlying metal catalyst required for graphene growth and transfer.

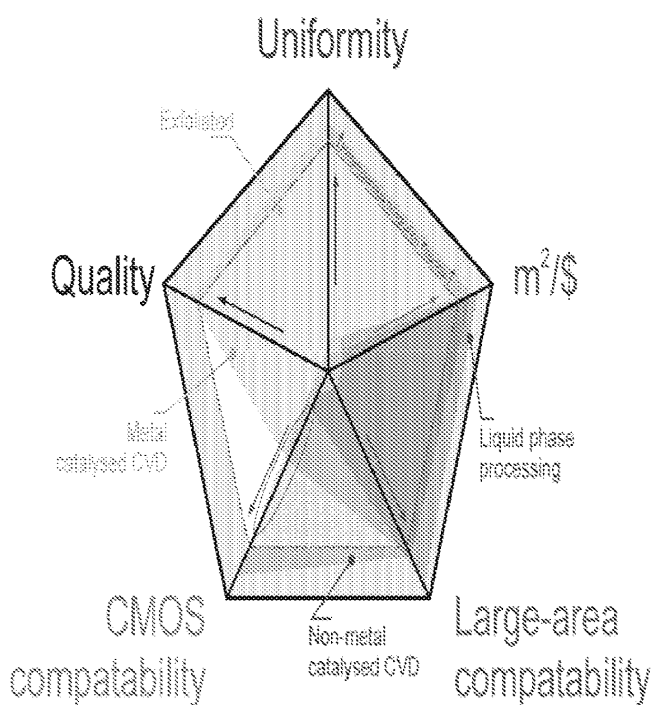
1

Summary & Description

- This invention disclosure describes a method of transferring multi-layer stacks formed from chemical vapor deposited graphene and oxide and metal layers to various arbitrary substrates via entirely dry-processing.
- Key summary of invention
 - Method of dry-transferring oxide/CVD graphene from metallic growth substrates to arbitrary substrates.
 - Novel approach of integrating graphene onto CMOS processing for RF and GHz and THz electronics.
 - Proposed integration approach can be extended to flat panel systems on rigid and flexible substrates as related to displays, imaging and other applications.

Background: State-of-the-Art Graphene Deposition & Transfer Technologies

Graphene, a two-dimensional honeycomb of single carbon atoms, has a wide variety of interesting and novel physical, chemical, optical and electronic properties. The potential engineering applications of the material are wide and far reaching. However, issues remain with its processing and the availability of suitable transfer techniques.



Liquid phase approaches (inkjet, spray coating, Langmuir-Blodgett, dip casting, etc.) where aggressive acid baths and high power sonication produce large area films formed from small sub-10 μm flakes is a leading thin film fabrication technique. These ensembles of graphitic flakes however are more similar in many ways to graphite rather than true mono or few layer graphene and as such are of little benefit to many envisaged applications, particularly in the remit of analogue electronics. Indeed, any wet chemistry will induce artificial doping of the graphene which masks its native properties, thereby reducing its general applicability. Chemical vapour deposition is thus far the only route of producing low-cost, highly crystalline large area films and has recently been shown to afford comparable degrees of graphitic quality to exfoliated samples.

There currently exists no practical solution to transfer graphene from its growth catalyst (typical a thin metal film) to arbitrary substrates without polymer mediators or wet chemical processing.

Stat-of-the-art in CVD graphene transfer (1/4)

Pertinent / Seminal Literature

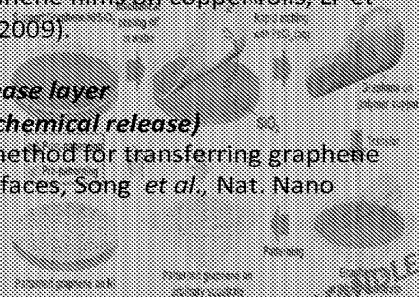
1) Polymer-Mediated

PMMA, PDMS, etc.

- Large-scale pattern growth of graphene films for stretchable transparent electrodes, Kim *et al.*, Nature (2009).
- Large-area synthesis of high-quality and uniform graphene films on copper foils, Li *et al.*, Science (2009).

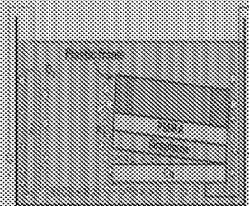
**Polymer release layer
(thermal or chemical release)**

- A general method for transferring graphene onto soft surfaces, Song *et al.*, Nat. Nano (2013).



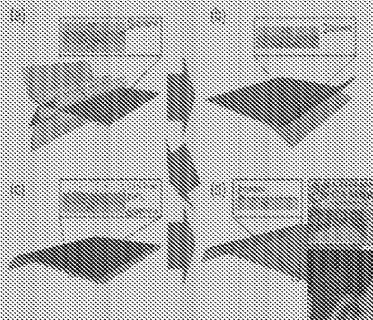
2) Bubbling

- Frame assisted H₂O electrolysis induced H₂ bubbling transfer of large area graphene grown by chemical vapor deposition on Cu, Sun *et al.*, Appl. Phys. Lett., 102, 022101 (2012).
- Repeated growth and bubbling transfer of graphene with millimetre-size single-crystal grains using platinum, Gao *et al.* Nat. Commun. 3, 699 (2012).



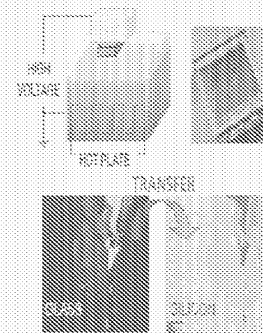
3) Hot Press Lamination

- Roll-to-roll production of 30-inch graphene films for transparent electrodes, S. Bae *et al.*, Nature Nanotechnology, 5, 574-578 (2010).



Anodic Bonding

- High Yield Production and transfer of graphene flakes obtained by anodic bonding, T. Moldt *et al.*, ACS Nano 5, 10, 7700-7705 (2011).
- Anodic bonded graphene, A. Balan *et al.*, J. Phys. D: Appl. Phys, 43, 374013 (2010).



Stat-of-the-art in CVD graphene transfer (2/4)

1) Polymer-Mediated

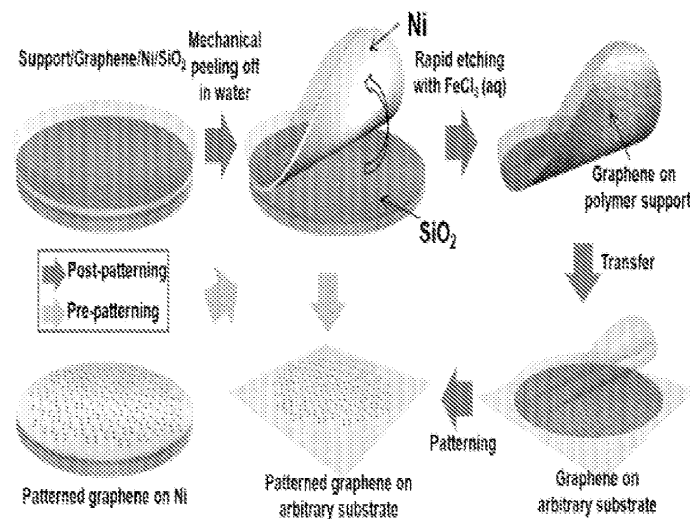
A mediator polymer such as polymethyl methacrylate (PMMA) or polydimethylsiloxane (PDMS) is first spin coated on the CVD grown graphene with the graphene still supported on its growth catalysts, typically a metal foil or a Si/SiO₂/metal thin film stack. The polymer coated sample is then bathed in a graphene catalyst etching layer, in the case of Cu this includes iron chloride or ammonium persulfate, which etches the entire catalyst material to release the graphene/polymer layer. This sandwiched can then be transferred to an arbitrary destination substrate. The polymer mediator is finally dissolved in acetone baths. Thermal and optical release tapes have also been used as alternatives to cast polymers.

The approach is:

- Simple / facile
- Transfer to arbitrary substrates possible
- Wide availability of suitable mediator polymers

Drawbacks of this approach include:

- Time consuming. Full catalyst etches can take up to 12 hrs.
- Doping of the graphene during wet-etching of the catalyst and the polymer handler
- Large-area incompatibility (max area < 3 x 3 cm)
- Requires complete etching of the catalyst → expensive
- A manual process which requires skilled technicians to process each sample. Reproducibility low. Automation challenging.



Stat-of-the-art in CVD graphene transfer (3/4)

2) Bubbling

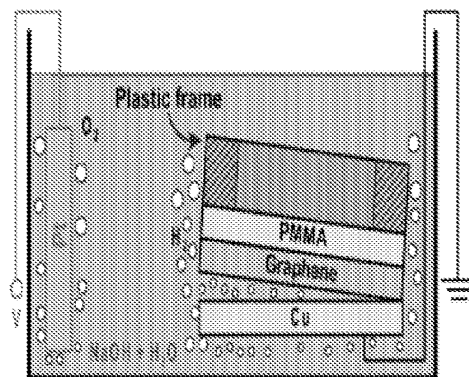
Bubbling transfer is very similar to polymer mediated transfer. As before, a polymer handler is deposited by either casting, spray coating or similar method, however the primary difference being that the rather than etching the entire catalyst layer a potentiostat is used to induce H_2 bubble formation at the graphene-catalyst interface which releases the graphene/polymer layer before much of the bulk catalyst has been chemically etched.

The approach is:

- Less expensive than simple polymer mediated approaches as the entire catalyst bed is not etched
- Rapid. The graphene/polymer stack is released much quicker than simple polymer mediated transfer
- Use of frame handlers increases ease of processing

Drawbacks of this approach include:

- Large area incompatible. Limited to areas $< 3 \times 3$ cm.
- Wet-chemistry based requiring expensive chemicals and an a potentiostat electrode that requires replacement over time
- Significant graphene doping unavoidable
- Aggressive transfer may damage the graphene



Stat-of-the-art in CVD graphene transfer

(4/4)

3) Hot Press Lamination

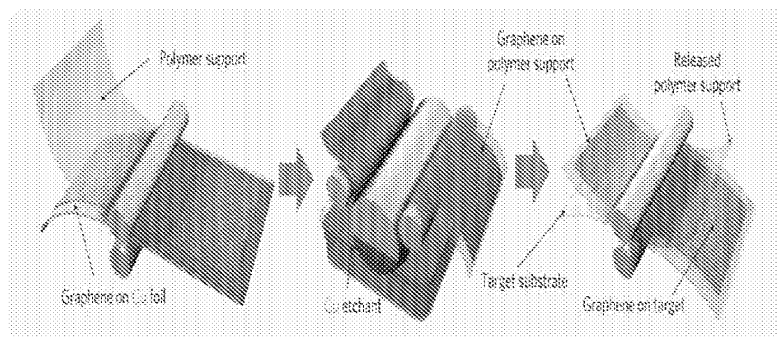
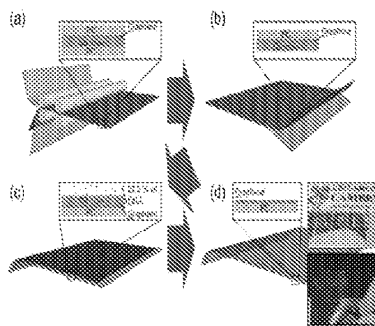
CVD graphene grown on foil catalyst is sandwiched between a thermally curable polymer support that is compressed and heated through a standard lamination process. The underside catalyst is then exposed to the wet-etchant, the top polymer support is removed, and the flexible transparent graphene thin film remains.

The approach is:

- Very large compatible (> 30 inch demonstrated)
- Transfer area only limited by CVD reactor size
- Facilitates flexible transparent electronics
- Truly roll-to-roll processing viable

Drawbacks of this approach include:

- Graphene doping by laminate
- Laminate compromises intrinsic electronic transport properties making high end device challenging (e.g. RF electronics)
- Requires complete etching of the catalyst → expensive
- CMOS incompatible
- Can only transfer graphene grown on foil or mechanically flexible catalysts. Rigid / brittle substrates cannot be processed over large areas



Invention Disclosure

- Disclosed embodiment is amenable to the fabrication of thin film transistor, photodetector, CMOS field effect transistors, chemristors, pelistors, touch sensors as well as large area transparent flexible antenna arrays and micro-electro-mechanical relays and other similar devices.
- Disclosed embodiment encompasses transfer of the oxide / CVD graphene stack. From here on, referring to “OGAS”
- The method is described herein.

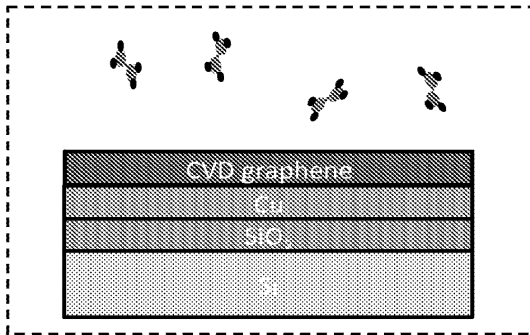
Anodic bonding: An electrical and thermal driven process which typically bonds Si to glass substrate. The substrates are placed between two metal electrodes and heated to ca. 400°C whilst application of a DC potential of up to 1kV. At the wafers interface an electric field is created causing ion depletion and the consequent attraction and species diffusion forms a solid chemical bond.

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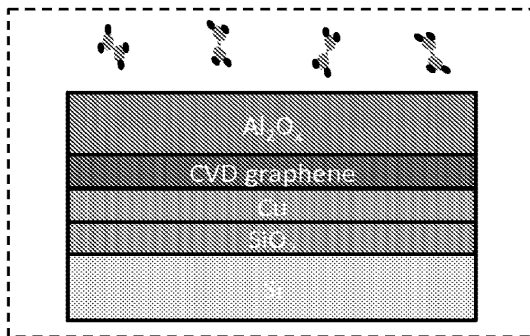
Oxide / Graphene stacks on Arbitrary Substrates:

OGAS Anodic Bonding Process

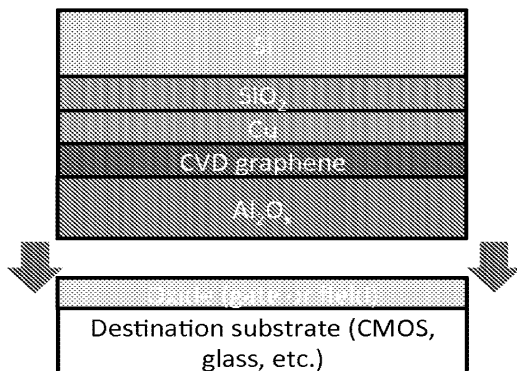
1) Graphene CVD



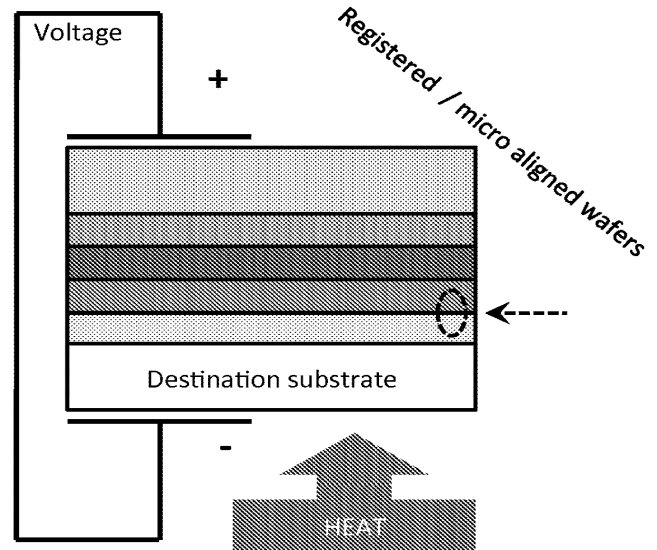
2) Oxide deposition



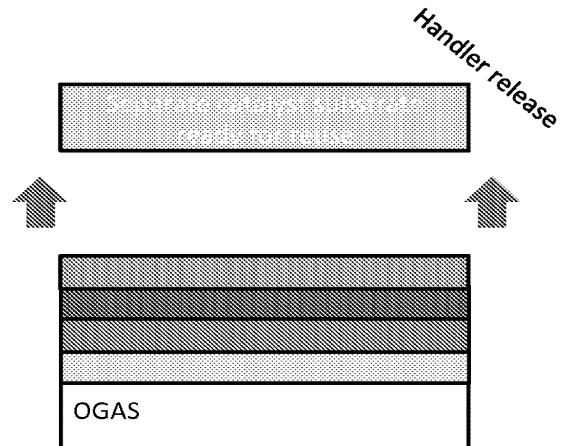
3) Land on destination



4) Anodic bonding



5) Handler removal



Benefits

1. **Improved graphene-oxide interface; defect free, low trap density**
2. Enhanced electronic characteristics
3. Reduced graphene doping → no wet chemistry
4. Inexpensive → no catalyst etching necessary
5. Rapid transfer per unit area
6. Large area compatibility → transfer size only limited by the size of the growth substrate
7. Compatible with a wide range of substrates (CMOS, high temperature compatible plastics, rigid and flexible glass, quartz, etc.)
8. A thermally and electrostatically driven bonding process compatible with automation
9. Potential to pattern the residual metal catalyst layer to form pre-deposited electrodes thereby reducing the total number of device fabrication process steps

Drawbacks include:

1. High voltage requirement
2. Thermal budget limited by minimum transfer temperature (ca. 200°C) making post-processing of CMOS and some polymers challenging

Claims

Method for the dry-transfer of high quality graphene/oxide stacks to glass and similar, destination substrates.

- I. Said method consists of anodic bonding an oxide/graphene bilayer from a chemical vapour deposited catalyst support to a destination substrate as a route to the large area fabrication of various electronics devices.
- II. Destination substrates include, for example, pre-processed CMOS substrates, rigid and flexible glass, metal foils, quartz, silicon, oxidized silicon, high temperature compatible polymers, borofloat and Pyrex borosilicate.
- III. Following chemical vapour deposition, said catalyst/graphene (where the “catalyst” pertains to either a Cu, Ni or some other catalytically active metal, foil or physical vapour deposited thin film on oxidised silicon) are coated with high-k dielectrics such as alumina, hafnia or silica, by plasma enhanced chemical vapour deposition, remote plasma sputtering or atomic layer deposition.
- IV. One skilled in the art shall be able to extend what has been disclosed above to other semi-conductor technologies without the loss of generality.

Pre-existing Patents

Google Patent (“anodic bonding graphene”, hits = 3,650)

Relevant Hits

- Anodic bonding of a stack of conductive and glass layers (US 6475326 B2, Nov. 2002)
- Method of bonding carbon nanotubes (US 8262835 B2, Sep. 2012)

No patents on anodic bonding of oxide/graphene stacks to wafers were found.

General Reference Patents (“anodic bonding”, hits = 255,000)

- Anodic bonding (3397278, Oct. 1966)
- Method of anodic bonding a semiconductor wafer to an insulator (US 5141148 A, Aug. 1992)
- Method of anodic wafer bonding (US 5866469 A, Feb 1999)
- Method for bonding an insulator and a conductor (EP 0619598 B1, June 1999)
- Method relating to anodic bonding (WO 2001029890 A2, Apr. 2001)
- Method for anodic bonding (US 6417478 B1, July 2002)
- Bonding method and product (WO 2003006396 A1, Jan. 2003)
- Low temperature anodic bonding method using focused energy for assembly of micromachined systems (WO 2004011368 A3, June 2004)
- Method for anodic bonding of wafers and device (US 20050112843 A1, May 2005)
- Anodic bonding method and electronic device having anodic bonding structure (US 7153758 B2, Dec 2006)
- Anodic bonding method and its use to manufacture an electronic device (EP 1462422 A3, Nov. 2007)
- Anodic bonding of polymers to glass, silicon or other materials (WO 2007129983 A1, Nov. 2007)
- Methods for anodic bonding material layers to one another and resultant apparatus (WO 2012078541 A2, June 2012)

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		Dry Transfer of Oxide CVD Graphene Stacks via Anodic Bonding		
First Named Inventor/Applicant Name:		Arokia Nathan		
Filer:		Arokia Nathan		
Attorney Docket Number:				
Filed as Large Entity				
Provisional Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Provisional Application Filing	1005	1	260	260
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				260

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EFS ID:	16197278
Application Number:	61841360
International Application Number:	
Confirmation Number:	3603
Title of Invention:	Dry Transfer of Oxide CVD Graphene Stacks via Anodic Bonding
First Named Inventor/Applicant Name:	Arokia Nathan
Correspondence Address:	Arokia Nathan - 189 Huntingdon Road - Cambridge CB3 0DL GB 44-1223-279135 an299@cam.ac.uk
Filer:	Arokia Nathan
Filer Authorized By:	
Attorney Docket Number:	
Receipt Date:	30-JUN-2013
Filing Date:	
Time Stamp:	08:07:40
Application Type:	Provisional

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Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$ 260

RAM confirmation Number		10482			
Deposit Account					
Authorized User					
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Abstract	GrapheneStacksTransfer.pdf	1039318	no	12
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Warnings:					
Information:					
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Warnings:					
Information:					
Total Files Size (in bytes):			1068367		
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