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13281 U.S.PTO 030205

UTILITY PATENT APPLICATION TRANSMITTAL

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

Attorney Docket No.	CRF D-2759
First Inventor	James R. SHEALY
Title	See 1 in Addendum
Express Mail Label No.	

112959 U.S.PTO 11/069040 030205

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

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

1. ☐ Fee Transmittal Form (e.g., PTO/SB/17) *(Submit an original and a duplicate for fee processing)*
2. ☐ Applicant claims small entity status. See 37 CFR 1.27.
3. ☒ Specification [*Total Pages* 13] *(preferred arrangement set forth below)*
   - Descriptive title of the invention
   - Cross Reference to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to sequence listing, a table, or a computer program listing appendix
   - Background of the Invention
   - Brief Summary of the Invention
   - Brief Description of the Drawings *(if filed)*
   - Detailed Description
   - Claim(s)
   - Abstract of the Disclosure
4. ☒ Drawing(s) (*35 U.S.C. 113*) [*Total Sheets* 1]
5. Oath or Declaration [*Total Sheets*]
   a. ☐ Newly executed (original or copy)
   b. ☐ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional with Box 18 completed)*
      i. ☐ DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) name in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. ☒ Application Data Sheet. See 37 CFR 1.76
7. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program *(Appendix)*
8. Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all necessary)*
   a. ☐ Computer Readable Form (CRF)
   b. Specification Sequence Listing on:
      i. ☐ CD-ROM or CD-R (2 copies); or
      ii. ☐ Paper
   c. ☐ Statements verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

9. ☐ Assignment Papers (cover sheet & document(s))
10. ☐ 37 CFR 3.73(b) Statement *(when there is an assignee)* ☐ Power of Attorney
11. ☐ English Translation Document *(if applicable)*
12. ☐ Information Disclosure Statement (IDS)/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. ☐ Nonpublication Request under 35 U.S.C. 122 (b)(2)(B)(i). Applicant must attach form PTO/SB/35 or its equivalent.
17. ☐ Other: .....

18. If a CONTINUING APPLICATION, *check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76:*

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

Prior application information: *Examiner* _____ *Art Unit:* _____

For CONTINUATION OF DIVISIONAL APPS only; The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 5b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

19. CORRESPONDENCE ADDRESS

☒ Customer Number: 23294 *OR* ☐ Correspondence address below

Name					
Address					
City		*State*		*Zip Code*	
Country		*Telephone*		*Fax*	

Name (Print/Type)	Jennifer P. Yancy	*Registration No. (Attorney/Agent)*	47,003
Signature	Jennifer P. Yancy	*Date*	03/02/2005

This collection of information is required by 37 CFR 1.53(b). 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.**

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Addendum

1. Single Step, High Temperature Nucleation Process for a Lattice Mismatched Substrate

SINGLE STEP, HIGH TEMPERATURE NUCLEATION PROCESS FOR A LATTICE MISMATCHED SUBSTRATE

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0001] This invention was made with Governmental support from the Office of Naval Research under Contract No. N00014-96-1-1223 and DARPA under Contract No. DABT63-C95-0121. The Government has certain rights in the invention.

BACKGROUND ON THE INVENTION

1. Field of the Invention

[0002] The present invention relates to a single step process for the nucleation and subsequent epitaxial growth on a lattice mismatched substrate.

2. Description of Related Art

[0003] Heteroepitaxial growth of GaN and related alloys on severely mismatched substrates such as sapphire, SiC and silicon requires thin nucleation layers to provide nucleation sites to initiate crystal growth. When optimized, these nucleation layers accommodate the strain between the substrate and epitaxial layers caused by lattice and thermal mismatches, while still maintaining crystallographic registration of the epitaxial films to the substrate lattice structure. The most commonly accepted practice for nucleation of these substrates with GaN-based material utilizes a two-temperature process involving either one or two flow paths. In addition, different growth

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pressures are used on certain steps in the nucleation process. In this fashion, high structural and electrical quality epitaxial films can be realized in severely mismatched material systems.

BRIEF SUMMARY OF THE INVENTION

[0004] The present invention is a single step process for the nucleation and subsequent epitaxial growth on a lattice mismatched substrate. A nucleation layer and a buffer layer are formed on the lattice mismatched substrate prior to the formation of an epitaxial layer. The epitaxial layer preferably includes a III-V compound or a II-VI compound. Crystal growth can be carried out by any conventional means such as organometallic vapor phase epitaxy (OMVPE), molecular beam epitaxy (MBE), or atomic layer epitaxy. The techniques for crystal growth preferably involve flow (beam) modulation, growth at atmospheric or reduced pressures, as well as various precursor chemistries that are widely accepted in the industrial and research communities.

[0005] In a preferred embodiment, a lattice mismatched substrate is pre-treated with a group III reactant or a group II reactant at an elevated growth temperature prior to the addition of a group V reactant or a group VI reactant and the growth of a nucleation layer. The group III reactant or the group II reactant is introduced into a growth chamber to pre-treat a surface of the substrate. Then, a nucleation layer is formed by introducing the group V reactant or the group VI reactant into the growth chamber. In a preferred embodiment, the nucleation layer is $Al_xGa_{1-x}N$ where x varies from 0 to 1. A buffer layer, preferably GaN, is formed on the nucleation layer to provide a surface upon which the epitaxial layer is grown. In a preferred embodiment, aluminum reacts with the surface of the substrate providing the needed nucleation sites while gallium prepares the aluminum saturated surface for subsequent growth of the epitaxial layer, preferably an epitaxial layer including AlN, AlGaN, or GaN.

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[0006] The present single step process is a single flow, single pressure, high temperature process. The single step process involves a surface treatment prior to epitaxial growth that allows complete coalescence of the epitaxial film within the first 200 Å of growth. This single step process eliminates the large temperature ramps and complex flow requirements of the commonly used two-step nucleation technologies.

BRIEF DESCRIPTION OF THE DRAWING(S)

[0007] The features and advantages of the present invention will become apparent from the following detailed description of a preferred embodiment thereof, taken in conjunction with the accompanying drawings, in which:

[0008] FIG. 1 is a schematic representation of one embodiment of the single step nucleation process.

DETAILED DESCRIPTION OF THE INVENTION

[0009] The present invention is a single step process, preferably a single flow, single pressure, high temperature nucleation process. This single step process for nucleation and subsequent growth of an epitaxial layer on a lattice mismatched substrate is achieved by pre-treating a surface of the substrate with at least one group III reactant or at least one group II reactant prior to the introduction of a group V or a group VI reactant. The substrate is a mismatched substrate comprising a material that is lattice mismatched to an epitaxial layer to be grown thereon. Preferably, the mismatched substrate is silicon, sapphire or SiC. The reactants are generally selected from a group of compounds which are volatile near room temperature and can be vapor transported in a carrier gas. The group III reactant is preferably selected from the group

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consisting of a gallium reactant, an aluminum reactant, a boron reactant, and an indium reactant. Most preferably, the gallium reactant is triethylgallium (TEG) or trimethylgallium (TMG). Most preferably, the aluminum reactant is triethylaluminum (TEA) or trimethylaluminum (TMA). Most preferably, the boron reactant is triethylboron (TEB) or trimethylboron (TMB). Most preferably, the indium reactant is triethylindium (TEIn) or trimethylindium (TMIn). The group II reactant is preferably selected from the group consisting of a cadmium reactant and a zinc reactant. At least one group III reactant or at least one group II reactant is introduced into a growth chamber at an elevated growth temperature to pre-treat the surface of the substrate prior to any actual crystal growth. In a preferred embodiment, the elevated growth temperature is 900 to 1100 °C. In a preferred embodiment, more than one group III reactant or more than one group II reactant is introduced into the growth chamber. For example, two group III reactants, preferably a gallium reactant and an aluminum reactant, may be introduced into the growth chamber. Once the pre-treatment is complete, the group V reactant or the group VI reactant is introduced to begin the growth of the nucleation layer. Preferably, the group V reactant contains a nitrogen reactant, an arsenic reactant or a phosphorus reactant. In one preferred embodiment, the group V reactant is a group V hydride, most preferably ammonia, arsine or phosphine. In a second preferred embodiment, the group V reactant is a group V organic precursor, most preferably tertiarybutylarsine (TBAs) or tertiarybutylphosphine (TBP). Preferably, the group VI reactant contains a tellurium reactant or a sulfur reactant. After the nucleation layer is formed, a buffer layer is formed on the nucleation layer. The buffer layer provides a surface upon which the epitaxial layer is grown. The epitaxial layer includes a III-V compound or a II-VI compound. Preferably, the III-V compound or the II-VI compound includes, but is not limited to, AlN, GaN, AlGaN, BGaN, BInN, BAlN, CdTe, and ZnS.

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[0010] In a preferred embodiment, an $Al_xGa_{1-x}N$ nucleation layer where x varies from 0 to 1 is grown on a substrate. Generally, the aluminum content requirements increase from SiC, to sapphire, then to silicon for obtaining atomically flat two-dimensional epitaxial growth. In order to obtain the desired nucleation layer, the surface of the substrate is first cleaned with hydrogen near a growth temperature. The substrate is then subjected to the desired elevated growth temperature, preferably 900 to 1100 °C. After the growth temperature has stabilized, an aluminum reactant and a gallium reactant are introduced into the growth chamber to pre-treat the surface of the substrate prior to the introduction of a nitrogen source and nucleation layer growth. The exposure time and flux of the aluminum reactant and the gallium reactant depend again on the substrate material and the crystal qualities desired. Once the pre-treatment of the surface is complete, a nitrogen source, preferably ammonia, is introduced into the growth chamber to commence the deposition of a nucleation layer. Preferably, the nucleation layer is grown at the same elevated growth temperature used to pre-treat the surface of the substrate. This provides a nucleation layer of crystalline $Al_xGa_{1-x}N$ of a specific thickness and aluminum content. In the case of an AlN nucleation layer, the gallium reactant is stopped prior to the formation of the nucleation layer and then re-introduced after the AlN nucleation layer is formed. After the nucleation layer is formed, a buffer layer is grown on the nucleation layer. Preferably, the buffer layer is grown at the same elevated growth temperature used to pre-treat the surface of the substrate. In the preferred embodiment, the aluminum reactant is ramped down and switched out resulting in a preferred GaN buffer layer. The buffer layer provides a surface upon which the epitaxial layer is grown. In a preferred embodiment, a GaN buffer layer provides a surface on which GaN-based materials can subsequently be deposited without changing the temperature within the chamber.

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[0011] Numerous applications exist for a lattice mismatched substrate having an epitaxial nitride based material, such as (Al)GaN, in the areas of high power, high frequency electronics, short wavelength optoelectronics, biology, and micromachining technologies.

EXAMPLE 1

[0012] A schematic representation of a single step process for nucleation and subsequent growth of a preferred GaN-based material is shown in FIG. 1. Relative reactant fluxes and exposure cycles are depicted for the surface pre-treatment, the AlN/AlGaN nucleation layer, and the transition to GaN epitaxial growth on both sapphire and SiC substrates. For this example, flow modulation OMVPE is used for the growth.

[0013] A detailed description of the single step process depicted in FIG. 1 follows.

1. The substrates are heated up to 1100 °C in hydrogen for 10 minutes to clean the surface of the substrate.

2. After 10 minutes, the temperature is decreased to the growth temperature of 1040 °C.

3. After the temperature has stabilized, the aluminum reactant and the gallium reactant, preferably TEG and TMA, are introduced into the growth chamber. For sapphire substrates the TMA/TEG ratio is set at 0.15, while for SiC is fixed at 0.06. The substrates are exposed for 100 seconds.

4. Ammonia is then switched into the growth chamber, forming $Al_xGa_{1-x}N$ (x=0.06 for SiC, and x=0.15 for sapphire) on the metal rich substrate surface. Around 20 nm of AlGaN is grown.

5. The gallium reactant is switched into the growth chamber if not already present (in the case of an AlN nucleation layer).

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6. The aluminum reactant is then ramped down to 0.0 in 30 seconds, then switched out of the growth chamber.

7. This results in GaN deposition, providing a buffer layer on which other GaN-based epitaxial layers can subsequently be deposited without any change in growth chamber temperature.

EXAMPLE 2

[0014] The following is an example of a high electron mobility transistor (HEMT) nucleation sequence in accordance with the present invention. TEG and TMA flows are total flows, not actual organometallic flux. Temperature calibrations with a clean cell indicated 1016 °C was actually more like 1040 °C. The nucleation sequence is as follows:

1. The substrate is heated in hydrogen to a temperature of approximately 1060 °C. It generally takes about 14 minutes to ramp up from room temperature to approximately 1060 °C. The RF is on at a lower power for the first 4 minutes.

2. RF power is decreased to stabilize the substrate at the growth temperature of about 1016 °C. It takes about 10 minutes from turning RF down to the start of growth, typically arriving at the growth temperature about 5 minutes before growth.

3. An organometallic pre-treatment then begins, whereby TEG and TMA are switched into the cell to zone 1 for 100 sec for sapphire, 80 sec for SiC in the absence of the nitrogen source. TEG flow is at 90 sccm and TMA flow is adjusted based on previous runs, typically 15-25 sccm for sapphire, 5-15sccm for SiC. All procedures other than this step are the same for SiC and sapphire.

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4. TEG is switched out of the cell and ammonia is switched into zone 1 at approximately 4500sccm, and the balance of hydrogen flow to zone 1 is switched out, all simultaneously. Immediately after (1-2 sec.), ammonia is switched into the block at 1200 sccm for distribution to the rest of the cell. This causes some pressure fluctuations due to the sudden change in ammonia flow, affecting all flows in to the cell, but primarily the ammonia flow. It typically takes 20-30s to stabilize.

5. 60 sec. after ammonia is first switched in, TMA flow is increased from nucleation value to full AlN flow of about 90 sccm. This increase occurs somewhat slowly, over about 30 sec.

6. Continue growing AlN for 20 min.

7. Switch in TEG at full flow of approximately 90 sccm and simultaneously begin reducing TMA flow. Steadily decrease flow for 2 min. to zero and switch out.

8. 30 sec. after TMA switched out, raise ammonia flow to GaN buffer value of about 9000 sccm to zone 1, and 2600 sccm to block. GaN buffer is now grown.

[0015] Although the present invention has been disclosed in terms of a preferred embodiment, it will be understood that numerous additional modifications and variations could be made thereto without departing from the scope of the invention as defined by the following claims:

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What is claimed is:

1. A process for growing an epitaxial layer on a lattice mismatched substrate comprising the steps of:

a) providing a substrate;

b) pre-treating a surface of the substrate with at least one group III reactant or at least one group II reactant at an elevated growth temperature prior to introducing a group V reactant or a group VI reactant;

c) introducing a group V reactant or a group VI reactant to grow a nucleation layer on the surface of the substrate; and

d) growing a buffer layer on said nucleation layer, said buffer layer providing a surface upon which said epitaxial layer is grown.

2. The process of claim 1, wherein said substrate is selected from the group consisting of silicon, sapphire and SiC.

3. The process of claim 1, wherein said group III reactant is selected from the group consisting of a gallium reactant, an aluminum reactant, a boron reactant, and an indium reactant.

4. The process of claim 3, wherein said group III reactant is selected from the group consisting of triethylgallium, trimethylgallium, triethylaluminum, trimethylaluminum, triethylboron, trimethylboron, triethylindium and trimethylindium.

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5. The process of claim 1, wherein said group II reactant is a cadmium reactant or a zinc reactant.

6. The process of claim 1, wherein said step of pre-treating includes pre-treating the surface of the substrate with an aluminum reactant and a gallium reactant.

7. The process of claim 6, wherein said nucleation layer is AlN or AlGaN.

8. The process of claim 1, wherein said buffer layer is GaN.

9. The process of claim 1, wherein said epitaxial layer includes a compound selected from the group comprising AlN, GaN, AlGaN, BGaN, BInN, BAlN, CdTe, and ZnS.

10. The process of claim 1, further comprising the step of preheating said substrate in hydrogen prior to pre-treating the surface of the substrate with at least one group III reactant or at least one group II reactant.

11. The process of claim 1, wherein said elevated growth temperature is 900 to 1100 °C.

12. The process of claim 11, wherein the step of introducing a group V reactant or a group VI reactant includes growing a nucleation layer at a growth temperature of 900 to 1100 °C and the step of growing a buffer layer includes growing a buffer layer at a growth temperature of 900 to 1100 °C.

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13. The process of claim 1, wherein said group V reactant is a group V hydride.

14. The process of claim 13, wherein said group V hydride is selected from the group consisting of ammonia, arsine, and phosphine.

15. The process of claim 1, wherein said group V reactant is a group V organic precursor.

16. The process of claim 15, wherein said group V organic precursor is tertiarybutylarsine or tertiarybutylphosphine.

17. The process of claim 1, wherein said group VI reactant is a tellurium reactant or a sulfur reactant.

18. A process for growing an epitaxial layer on a lattice mismatched substrate comprising the steps of:

a) providing a substrate;

b) pre-treating a surface of the substrate with at least a first group III reactant and a second group III reactant at a growth temperature of 900 to 1100 °C prior to introducing a nitrogen source;

c) stopping a flow of the first group III reactant;

d) introducing a nitrogen source to grow a nucleation layer on the surface of the substrate;

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e) resuming the flow of the first group III reactant and reducing a flow of the second group III reactant;

f) stopping the flow of the second group III reactant; and

g) growing a buffer layer on said nucleation layer, said buffer layer providing a surface upon which said epitaxial layer is grown.

19. The process of claim 18, wherein said first group III reactant is a gallium reactant and said second group III reactant is an aluminum reactant.

20. The process of claim 19, wherein said gallium reactant is triethylgallium and said aluminum reactant is trimethylaluminum.

21. The process of claim 18, wherein said nucleation layer is AlN or AlGaN.

22. The process of claim 18, wherein said buffer layer is GaN.

23. The process of claim 18, wherein said epitaxial layer includes a compound selected from the group comprising AlN, GaN, AlGaN, BGaN, BInN, and BAlN.

24. The process of claim 18, further comprising the step of preheating said substrate in hydrogen prior to pre-treating the surface of the substrate with the first group III reactant and the second group III reactant.

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ABSTRACT OF THE DISCLOSURE

A single step process for nucleation and subsequent epitaxial growth on a lattice mismatched substrate is achieved by pre-treating the substrate surface with at least one group III reactant or at least one group II reactant prior to the introduction of a group V reactant or a group VI reactant. The group III reactant or the group II reactant is introduced into a growth chamber at an elevated growth temperature to wet a substrate surface prior to any actual crystal growth. Once the pre-treatment of the surface is complete, a group V reactant or a group VI reactant is introduced to the growth chamber to commence the deposition of a nucleation layer. A buffer layer is then grown on the nucleation layer providing a surface upon which the epitaxial layer is grown preferably without changing the temperature within the chamber.

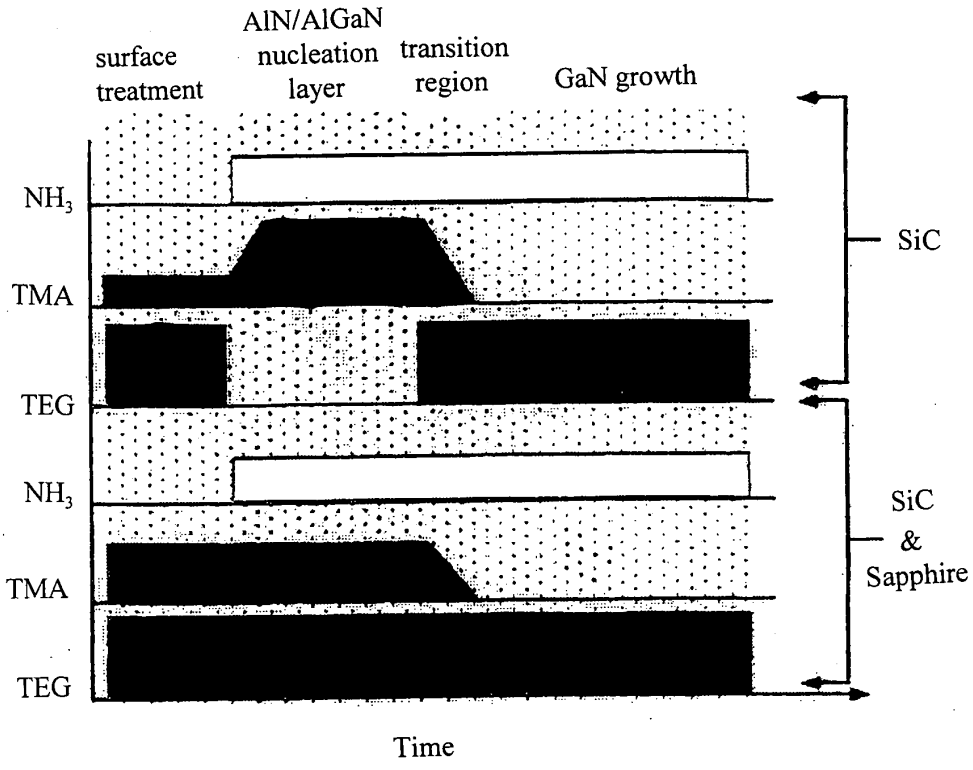


FIG. 1

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Practitioner's Docket No. CRF D-2759 *PATENT*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: James R. Shealy, Joseph A. Smart
Application No.: TBA
Filed: March 2, 2005
For: Single Step, High Temperature Nucleation Process for a Lattice Mismatched Substrate

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

APPLICATION DATA SHEET
37 C.F.R. § 1.76

BIBLIOGRAPHIC DATA

1. Applicant information

First applicant: James R. Shealy
Citizenship: US

Second applicant: Joseph A. Smart
Citizenship: US

2. Correspondence information

Correspondence for this application should be addressed as follows:

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JONES, TULLAR & COOPER, P.C.
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Arlington, VA 22202
Customer No.: 23294

3. Application information

Title of Invention: Single Step, High Temperature Nucleation Process for a Lattice Mismatched Substrate

Docket number assigned to this application: CRF D-2759

Total number of drawing sheets: 1

Type of application: Utility
Application is to be published. Suggested drawing figure for publication: 1

Secrecy order under § 5.2:

This application does not disclose subject matter of an application which is under a secrecy order pursuant to § 5.2.

Date: 03/02/2005

Jennifer P. Yancy

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APPLICATION NUMBER	FILING OR 371 (c) DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
11/069,040	03/02/2005	James R. Shealy	CRF D-2759

CONFIRMATION NO. 7614

23294
JONES, TULLAR & COOPER, P.C.
P.O. BOX 2266 EADS STATION
ARLINGTON, VA 22202

FORMALITIES LETTER

OC000000015789438

Date Mailed: 04/21/2005

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 statutory basic filing fee is missing.
  Applicant must submit $ **300** *to complete the basic filing fee for a non-small entity. If appropriate, applicant may make a written assertion of entitlement to small entity status and pay the small entity filing fee (37 CFR 1.27).*
- The oath or declaration is missing. *A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.*
  Note: If a petition under 37 CFR 1.47 is being filed, an oath or declaration in compliance with 37 CFR 1.63 signed by all available joint inventors, or if no inventor is available by a party with sufficient proprietary interest, is required.
- 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 applicant needs to satisfy supplemental fees problems indicated below.

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

- Additional claim fees of **$200** as a non-small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is **$1330** for a Large Entity

- **$300** Statutory basic filing fee.

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

- The application search fee has not been paid. Applicant must submit **$500** to complete the search fee.
- The application examination fee has not been paid. Applicant must submit **$200** to complete the examination fee for a large entity

- Total additional claim fee(s) for this application is **$200**
  - **$200** for **4** total claims over 20.

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.

Jena Jones

Office of Initial Patent Examination (703) 308-1202

PART 3 - OFFICE COPY

OIPE JC98 JUN 14 2005 UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NUMBER	FILING OR 371 (c) DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
11/069,040	03/02/2005	James R. Shealy	CRF D-2759

CONFIRMATION NO. 7614

FORMALITIES LETTER

OC000000015789438

23294
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P.O. BOX 2266 EADS STATION
ARLINGTON, VA 22202

06/16/2005 JBALINAN 00000012 11069040

01 FC:1011 300.00 OP
02 FC:1111 500.00 OP
03 FC:1311 200.00 OP
04 FC:1202 200.00 OP
05 FC:1051 130.00 OP

Date Mailed: 04/21/2005

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 statutory basic filing fee is missing.
  Applicant must submit $ **300** *to complete the basic filing fee for a non-small entity. If appropriate, applicant may make a written assertion of entitlement to small entity status and pay the small entity filing fee (37 CFR 1.27).*
- The oath or declaration is missing. *A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.*
  Note: If a petition under 37 CFR 1.47 is being filed, an oath or declaration in compliance with 37 CFR 1.63 signed by all available joint inventors, or if no inventor is available by a party with sufficient proprietary interest, is required.
- 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 applicant needs to satisfy supplemental fees problems indicated below.

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• Additional claim fees of **$200** as a non-small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is **$1330** for a Large Entity

- **$300** Statutory basic filing fee.

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

- The application search fee has not been paid. Applicant must submit **$500** to complete the search fee.
- The application examination fee has not been paid. Applicant must submit **$200** to complete the examination fee for a large entity

- Total additional claim fee(s) for this application is **$200**

  - **$200** for **4** total claims over 20.

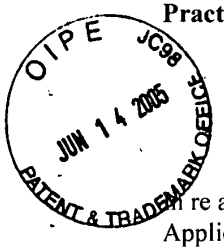
Replies should be mailed to: Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

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

Jena Jones

Office of Initial Patent Examination (703) 308-1202

PART 2 - COPY TO BE RETURNED WITH RESPONSE



Practitioner's Docket No. CRF D-2759 ***PATENT***

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Shealy, et.
Application No.: 11/069,040
Filed: 03/02/2005
For: SINGLE STEP, HIGH TEMPERATURE NUCLEATION PROCESS FOR A LATTICE MISMATCHED SUBSTRATE

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

COMPLETION OF FILING REQUIREMENTS
-- NONPROVISIONAL APPLICATION

I. This replies to the Notice to File Missing Parts of Application (PTO-1533) mailed April 21, 2005.

A copy of the Notice to File Missing Parts of Application--Filing Date Granted (Form PTO-1533) is enclosed.

DECLARATION OR OATH

II. No declaration or oath was filed. Enclosed is a copy of the original declaration or oath for this application.

ASSIGNMENT

III. Enclosed is an assignment for the above-identified patent application along with the required recordation cover sheet and fee.

INFORMATION DISCLOSURE STATEMENT

IV. Attached is an Information Disclosure Statement (IDS) along with the required Form PTO/SB/08A.



COMPLETION FEES

V.

1. Filing Fee
   Original patent application
   (37 C.F.R. Section 1.16(a)) $ 1200.00

2. Surcharge Fees
   Late payment of filing fee
   and/or late filing of original
   declaration or oath
   (37 C.F.R. Section 1.16(e)) $ 130.00

3. Assignment (See "ASSIGNMENT COVER SHEET") $ 40.00

Total Completion Fees **$ 1370.00**

EXTENSION OF TIME

VI. The proceedings herein are for a patent application, and the provisions of 37 C.F.R. Section 1.136(a) apply.

PAYMENT OF FEES

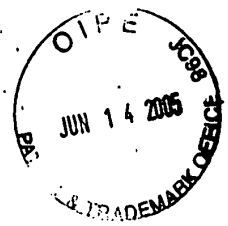
VII. Enclosed is a check in the amount of $1370.00 (check #19278)

AUTHORIZATION TO CHARGE ADDITIONAL FEES

VIII. The Commissioner is hereby authorized to charge additional fees that may be required by this paper to Account No. 10-1213.

Date: 06/14/2005

Jennifer P. Yancy
Registration No. 47,003
Jones, Tullar & Cooper, P.C.
P.O. Box 2266
Eads Station
Arlington, VA 22202
703-415-1500
Customer No. 23294



COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

This declaration is of the following type:

[x] original
[ ] design
[ ] supplemental
[ ] national stage of PCT
[ ] divisional
[ ] continuation
[ ] continuation-in-part (CIP)

My residence, post office address and citizenship are as stated 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 for and for which a patent is sought on the invention entitled:

Single Step, High Temperature Nucleation Process for a Lattice Mismatched Substrate

the specification of which

[ ] is attached hereto
[x] was filed on 03/02/2005, as
Application No. 11/069,040
and was amended on _____
(if applicable)
[ ] was described and claimed in PCT International Application No. _____
filed on _____ and as amended under PCT Article 19 on _____ (if any).

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

[x] In compliance with this duty there is attached an Information Disclosure Statement. 37 CFR 1.97.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119, of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent of inventor's certificate having a filing date before that of the application on which priority is claimed:

[x] no such applications have been filed
[ ] such applications have been filed as follows.

Prior Foreign Application(s)

(Number)	(Country)	(day/month/year filed)	[ ] Yes [ ] No
(Number)	(Country)	(day/month/year filed)	[ ] Yes [ ] No

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

(Application Number)	(Filing Date)
(Application Number)	(Filing Date)

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below, and insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose all information known to be material to patentability as defined in Title 37, Code of 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:

(Application No.)	(Filing Date)	(patented, pending, abandoned)
(Application No.)	(Filing Date)	(patented, pending, abandoned)

Qorvo - Exhibit 1002, Page 26

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agents to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

George M. Cooper, Reg. No. 20,201
William A. Blake, Reg. No. 30,548
Jennifer P. Yancy, Reg. No. 47,003

Douglas R. Hanscom, Reg. No. 26,600
J.Andrew McKinney, Reg. No. 34,672

Send correspondence to

Jennifer P. Yancy
JONES, TULLAR & COOPER, P.C.
P.O. Box 2266 Eads Station
Arlington, VA 22202

Direct telephone calls to

Jennifer P. Yancy
(703) 415-1500

I hereby declare 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 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 James R. SHEALY

Inventor's signature J R Shealy 5/11/05 (Date)

Residence US 615 Hopkins Rd, ITHACA, NY 14850

Citizenship US

Post Office Address None

Full name of second joint inventor, if any Joseph A. SMART

Inventor's signature _____ _____ (Date)

Residence US

Citizenship US

Post Office Address _____

Qorvo - Exhibit 1002, Page 27

PATENT & TRADEMARK OFFICE JUN 14 2005 JC08

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agents to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

George M. Cooper, Reg. No. 20,201
William A. Blake, Reg. No. 30,548
Jennifer P. Yancy, Reg. No. 47,003
Douglas R. Hanscom, Reg. No. 26,600
J.Andrew McKinney, Reg. No. 34,672

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P.O. Box 2266 Eads Station
Arlington, VA 22202

Direct telephone calls to

Jennifer P. Yancy
(703) 415-1500

I hereby declare 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 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 James R. SHEALY

Inventor's signature _____ (Date) _____

Residence US

Citizenship US

Post Office Address _____

Full name of second joint inventor, if any Joseph A. SMART

Inventor's signature Joseph A Smart (Date) 10 JUNE 2005

Residence US

Citizenship US

Post Office Address 358 BLUME ROAD, MOORESVILLE, NC 28117

BEST AVAILABLE COPY



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)
	)
SHEALY, et al.	)
	)
Application No. 11/069,040	)
	)
Filed: 03/02/2005	)
	)
For: SINGLE STEP, HIGH TEMPERATURE NUCLEATION PROCESS FOR A LATTICE MISMATCHED SUBSTRATE	)

INFORMATION DISCLOSURE STATEMENT

Assistant Commissioner of Patents
Alexandria, VA 22313

Sir.

Pursuant to the requirements of 37 C.F.R. 1.97 and 1.98, Applicant respectfully requests that the references listed in the attached Form PTO/SB/08A be considered and made of record in the above referenced application. Since the references are all U.S. Patents, we have not included copies of the references.

Respectfully submitted,

Jennifer P. Yancy
Registration No. 47,003

JONES, TULLAR & COOPER, P.C.
P.O. Box 2266 Eads Station
Arlington, VA 22202
Telephone (703) 415-1500
Dated: June 14, 2005

JC98
JUN 14 2005
PATENT & TRADEMARK OFFICE

PTO/SB/08A (10-01)
Approved for use through 10/31/2002. OMB 0651-0031
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.

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	11/069,040
Filing Date	03/02/2005
First Named Inventor	James R. SHEALY
Art Unit	
Examiner Name	
Attorney Docket Number	CRF D-2759

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number: Number - Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 5834379	11/10/1998	Shealy	
		US- 6478871	11/12/2002	Shealy	
		US-			
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FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document: Country Code[3] - Number[4] - Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

Burden Hour Statement: This form is estimated to take 2.0 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

11/069040

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	0	11/069040	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 15:58
L2	2	("11069040").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 15:59
L3	0	group-II and group-III and group-V and group-VI and epitaxial and reactant	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:01
L4	0	group-II and group-V and group-VI and epitaxial and reactant	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:02
L5	0	group-II and group-V and epitaxial and reactant	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:02
L6	0	group-VI and group-V and epitaxial and reactant	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:02
L7	2	OMVPE and HEMT and AlN and AlGaN and epitaxial and reactant and SiC	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:04

EAST Search History

L8	2	7 and (group-II or group-III or group-V or group-VI or sapphire or SiC or surface or buffer or epitaxial or growth or reactant or silicon or nucleation or grow or lattice or mismatched or substrate or pre-heating or pre-treatment or pre-annealing)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:40
L9	1	"6218280".PN.	USPAT; USOCR	OR	OFF	2006/08/22 16:24
L10	1	"6177292".PN.	USPAT; USOCR	OR	OFF	2006/08/22 16:25
L11	1	"6136093".PN.	USPAT; USOCR	OR	OFF	2006/08/22 16:25
L12	1	"5954874".PN.	USPAT; USOCR	OR	OFF	2006/08/22 16:25
L13	1	"5909036".PN.	USPAT; USOCR	OR	OFF	2006/08/22 16:26
L14	1	"5858086".PN.	USPAT; USOCR	OR	OFF	2006/08/22 16:26
L15	1	9 and (group-II or group-III or group-V or group-VI or sapphire or SiC or surface or buffer or epitaxial or growth or reactant or silicon or nucleation or grow or lattice or mismatched or substrate or pre-heating or pre-treatment or pre-annealing)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:36
L16	1	"5625202".PN.	USPAT; USOCR	OR	OFF	2006/08/22 16:34
L17	1	10 and (group-II or group-III or group-V or group-VI or sapphire or SiC or surface or buffer or epitaxial or growth or reactant or silicon or nucleation or grow or lattice or mismatched or substrate or pre-heating or pre-treatment or pre-annealing)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:37
L18	1	11 and (group-II or group-III or group-V or group-VI or sapphire or SiC or surface or buffer or epitaxial or growth or reactant or silicon or nucleation or grow or lattice or mismatched or substrate or pre-heating or pre-treatment or pre-annealing)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:38

EAST Search History

L19	1	12 and (group-II or group-III or group-V or group-VI or sapphire or SiC or surface or buffer or epitaxial or growth or reactant or silicon or nucleation or grow or lattice or mismatched or substrate or pre-heating or pre-treatment or pre-annealing)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:39
L20	1	13 and (group-II or group-III or group-V or group-VI or sapphire or SiC or surface or buffer or epitaxial or growth or reactant or silicon or nucleation or grow or lattice or mismatched or substrate or pre-heating or pre-treatment or pre-annealing)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:39
L21	1	14 and (group-II or group-III or group-V or group-VI or sapphire or SiC or surface or buffer or epitaxial or growth or reactant or silicon or nucleation or grow or lattice or mismatched or substrate or pre-heating or pre-treatment or pre-annealing)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:41
L22	2	("5679152").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:40
L23	2	22 and (group-II or group-III or group-V or group-VI or sapphire or SiC or surface or buffer or epitaxial or growth or reactant or silicon or nucleation or grow or lattice or mismatched or substrate or pre-heating or pre-treatment or pre-annealing)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:43
L24	2	("5625202").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:43
L25	2	24 and (group-II or group-III or group-V or group-VI or sapphire or SiC or surface or buffer or epitaxial or growth or reactant or silicon or nucleation or grow or lattice or mismatched or substrate or pre-heating or pre-treatment or pre-annealing)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:46

EAST Search History

L26	2	("6596079").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:46
L27	2	26 and (group-II or group-III or group-V or group-VI or sapphire or SiC or surface or buffer or epitaxial or growth or reactant or silicon or nucleation or grow or lattice or mismatched or substrate or pre-heating or pre-treatment or pre-annealing)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:48
L28	190	438/341	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:48
L29	109	438/363	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:49
L30	123	438/416	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:49
L31	143	438/502	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:49
L32	1141	438/660	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:49
L33	501	438/663	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:49

EAST Search History

L34	1084	438/688	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:49
L35	113	438/603	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:49
L36	357	438/604	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:49
L37	181	438/606	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:49
L38	226	438/608	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:50
L39	111	438/913	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:50
L40	336	438/931	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:50
L41	226	438/933	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2006/08/22 16:50

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 NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/069,040	03/02/2005	James R. Shealy	CRF D-2759	7614

23294 7590 09/05/2006

JONES, TULLAR & COOPER, P.C.
P.O. BOX 2266 EADS STATION
ARLINGTON, VA 22202

EXAMINER	
NHU, DAVID	

ART UNIT	PAPER NUMBER
2818	

DATE MAILED: 09/05/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	11/069,040	SHEALY ET AL.	
	Examiner	Art Unit	
	David Nhu	2818	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 March 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *18-24* is/are allowed.

6)☒ Claim(s) *1-9 and 13-16* is/are rejected.

7)☒ Claim(s) *10-12 and 17* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *6/14/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTIONS

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-9, 13-16 are rejected under 35 U.S.C. 102(b) as being anticipated by Kryliouk et al (6,218,280 B1).

Regarding claim 1, Kryliouk, (see figure 1B, col. 6, lines 15-67, col. 7, lines 1-67), teaches a process for growing an epitaxial layer (GaN) on a lattice mismatched substrate comprising: providing a substrate; pre-treating a surface of the substrate with at least one group III reactant at an elevated growth temperature prior to introducing a group V reactant; introducing a group V reactant to grow a nucleation layer on a surface of the substrate; and growing a buffer layer (MOVPE GaN) on said nucleation layer, said buffer layer providing a surface upon which said epitaxial layer is grown.

Regarding claims 2-9, 13-16, Kryliouk also teaches the substrate is SiC, silicon; the group III reactant is a gallium...; the group III reactant is TMG, ; the pre-treating the surface of the substrate with an gallium and aluminum; the nucleation layer is AlN or AlGaN; the buffer layer is GaN; the epitaxial layer is AlN, GaN...; the group V reactant is a group V hydride and consists ammonia, phosphine, and is a group V organic precursor...

Allowable Subject Matter

3. Claims 18-24 are allowed.

The reason for allowance: Kryliouk does not teach pre-treating a surface of the substrate with at least a first group III reactant and a second group III reactant at a growth temperature of 900°C to 1100°C prior to introducing a nitrogen source; stopping a flow of the first group III reactant; introducing a nitrogen source to grow a nucleation layer on the surface of the substrate; resuming the flow of the first group III and reducing a flow of the second group III reactant; stopping the flow of the second group III reactant.

4. Claims 10-12, 17 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Kryliouk does not teach the pre-heating said substrate in hydrogen prior to pre-treating the surface of the substrate with at least one group III reactant or at least one group II reactant; the elevated growth temperature is 900°C to 1100°C; introducing a group V reactant or a group VI reactant includes growing a nucleation layer at a growth temperature of 900°C to 1100°C and the step of growing a buffer layer includes growing a buffer layer at a growth temperature of 900°C to 1100°C; the group VI reactant is a tellurium reactant or a sulfur reactant.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: Chai'202 is cited as of interest.

6. A shortened statutory period for response to this action is set to expired 3 (three) months from the date of this letter. Failure to respond within the period for response will cause the application to become abandoned (see 710.02 (b)).

7. Any inquiry concerning this communication on earlier communications from the examiner should be directed to David Nhu, (571)272-1792. The examiner can normally be reached on Monday-Friday from 7:30 AM to 5:00 PM. *The fax phone number for the organization where this application or proceeding is assigned is (571)273-8300.*

Information regarding the status of an application may be obtained from the patent application information retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

David Nhu

August 23, 2006

JC998
JUN 14 2005
PATENT & TRADEMARK OFFICE

PTO/SB/08A (10-01)
Approved for use through 10/31/2002. OMB 0651-0031
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.

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	11/069,040
Filing Date	03/02/2005
First Named Inventor	James R. SHEALY
Art Unit	
Examiner Name	
Attorney Docket Number	CRF D-2759

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number - Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
DS		US-5834379	11/10/1998	Shealy	
DS		US-6478871	11/12/2002	Shealy	
		US-			
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FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] -Number[4] -Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]

Examiner Signature		Date Considered	8/23/06

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

Burden Hour Statement: This form is estimated to take 2.0 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

Notice of References Cited	Application/Control No. 11/069,040	Applicant(s)/Patent Under Reexamination SHEALY ET AL.	
	Examiner David Nhu	Art Unit 2818	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-6,218,280 B1	04-2001	Kryliouk et al.	438/607
	B	US-6,177,292 B1	01-2001	Hong et al.	438/46
	C	US-5909036	06-1999	Tanaka et al	257/94
	D	US-5679152	10-1997	Tischler et al	117/97
	E	US-5625202	04-1997	Chai	257/94
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes

Application/Control No.	Applicant(s)/Patent under Reexamination
11/069,040	SHEALY ET AL.
Examiner	**Art Unit**
David Nhu	2818

SEARCHED			
Class	Subclass	Date	Examiner
438	603	8/23/2006	DN
	604, 606		
	608, 688		
	660. 663		
	341, 363		
	416, 502		
	913		
	931, 933		

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
SEARCHED IN EAST	8/23/2006	DN

Index of Claims



Application/Control No.	Applicant(s)/Patent under Reexamination
11/069,040	SHEALY ET AL.
Examiner	**Art Unit**
David Nhu	2818

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date
Final	Original	8/23/06
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UNITED STATES PATENT AND TRADEMARK OFFICE

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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

Bib Data Sheet

CONFIRMATION NO. 7614

SERIAL NUMBER	FILING OR 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
11/069,040	03/02/2005 RULE	438	2818	CRF D-2759

APPLICANTS

James R. Shealy, Ithaca, NY;
Joseph A. Smart, Mooresville, NC;

** CONTINUING DATA **********

NONE

** FOREIGN APPLICATIONS **********

NONE

IF REQUIRED, FOREIGN FILING LICENSE GRANTED
** 04/19/2005

		STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed	☐ yes ☑ no	NY	1	24	2
35 USC 119 (a-d) conditions met	☐ yes ☑ no ☐ Met after Allowance				
Verified and Acknowledged	Examiner's Signature Initials				

ADDRESS
23294

TITLE

Single step, high temperature nucleation process for a lattice mismatched substrate

FILING FEE RECEIVED		
1330	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
	)	Docket No.: CRF D-2759
James R. SHEALY	)	
	)	Examiner: Nhu, David
Application No.: 11/069,040	)	
	)	Art Unit: 2818
Filed: 03/02/2005	)	
	)	
For: SINGLE STEP, HIGH TEMPERATURE NUCLEATION PROCESS FOR A LATTICE MISMATCHED SUBSTRATE	)	

RESPONSE TO OFFICE ACTION

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

Sir:

This letter is in Response to the Office Action that was mailed on September 5, 2006.

REMARKS

Claims 1-9, 13-16 stand rejected under 35 U.S.C. 102(b) as being anticipated by Kryliouk et al. (6,218,280). The claims of the present invention are directed to a process for growing an epitaxial layer on a lattice mismatched substrate including a pre-treating step. The pre-treating step includes subjecting the surface of the substrate to at least one group III reactant or at least one group II reactant prior to introducing a group V reactant or a group VI reactant. Therefore, the group III reactant and the group II reactant do not include a group V reactant or a Group VI reactant. Additionally, the present invention is directed to growing the epitaxial layer on a silicon, sapphire or SiC substrate (see claim 2). The Kryliouk reference specifically teaches simultaneously subjecting the substrate to a group III reactant (TMG reacted with HCl) and a group V reactant (NH_3) – see column 7, lines 5-15 and FIG. 1A. Additionally, the Kryliouk reference does not disclose the preferred substrates (silicon, sapphire and SiC) that are listed in claim 2. The Kryliouk reference provides oxide substrates including $LiGaO_2$, $LiAlO_2$, $MgAlScO_4$, Al_2MgO_4, and $LiNdO_2$. There is no teaching or suggestion in Kryliouk that the substrates used for the epitaxially growth are the substrates presented in claim 2 of the present application. For the foregoing reasons, Applicant submits that the rejection has been overcome and requests reconsideration and allowance of the present claims.

Claims 18-24 are allowed.

Claims 10-12, 17 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base

Qorvo - Exhibit 1002, Page 47

claim and any intervening claims. Applicant submits that base claims are now in condition for allowance. Therefore, Applicant submits that this objection has been overcome and requests reconsideration and allowance of the claims.

In view of the foregoing, Applicants respectfully submit that the art rejections are overcome and that the application is now in condition for allowance. Accordingly, favorable reconsideration and allowance of the claims is respectfully requested.

Respectfully submitted,

Dated: 08 December 2006

By: /Jennifer P. Yancy/ .

Jennifer P. Yancy
Reg. No. 47,003

Jones, Tullar & Cooper, P.C.
P.O. Box 2266 Eads Station
Arlington, VA 22202
Phone: (703) 415-1500
FAX: (703) 415-1508

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of)
)
James R. SHEALY)
) Group Art Unit: 2818
Patent Application No.: 11/069,040)
) Examiner: Nhu, David
Filed: 03/02/2005)
)
For: SINGLE STEP, HIGH TEMPERATURE)
NUCLEATION PROCESS FOR A)
LATTICE MISMATCHED SUBSTRATE)

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

Sir:

Transmitted herewith is a response in the above identified application.

( ) No additional fee is required.
(X) An extension of a shortened statutory time for response under 37 CFR 1.136(a) is requested.
( ) A verified statement under 37 CFR 1.9 and 1.27.
( ) is enclosed.
( ) is of record in this application.

CLAIMS AS AMENDED						
	Claims Remaining after Amend.	Highest Number Paid For	Extra	RATE		Amount
				Large Entity	Small Entity	
No. of Claims in Excess of 20				50.00	25.00	
Independent Claims in Excess of 3				200.00	100.00	
First Presentation of Multiple Dependent Claims				360.00	180.00	
Extension Fee (X) One month ( ) Two Months () Three Months ( ) Four Months ( ) Five Months				 120.00 450.00 1020.00 1,590.00 2160.00	 60.00 225.00 510.00 795.00 1080.00	120.00

TOTAL FEE ..... $ 120.00

( ) A check in the amount of $__ is attached.

(x) Charge $ 120.00 to Deposit Account No. 10-1213.

(X) The Commissioner is hereby authorized to charge payment of the following fees during the pendency of this application or credit any overpayment to Deposit Account No. 10-1213.

(X) Any patent application processing fees under 37 CFR 1.17.

(X) Any filing fees under 37 CFR 1.16 for presentation of extra claims.

Respectfully submitted,

JONES, TULLAR & COOPER, P.C.

By: /Jennifer P. Yancy/
Jennifer P. Yancy
Reg. No. 47,003

JONES, TULLAR & COOPER, P.C.
P.O. Box 2266 Eads Station
Arlington, Virginia 22202
703-415-1500
Date: December 8, 2006

Electronic Patent Application Fee Transmittal

Application Number:	11069040
Filing Date:	02-Mar-2005
Title of Invention:	Single step, high temperature nucleation process for a lattice mismatched substrate
First Named Inventor/Applicant Name:	James R. Shealy
Filer:	Jennifer P. Yancy
Attorney Docket Number:	CRF D-2759

Filed as Large Entity

Utility Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 1 month with $0 paid	1251	1	120	120

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
			Total in USD ($)	**120**

Electronic Acknowledgement Receipt	
EFS ID:	1361570
Application Number:	11069040
International Application Number:	
Confirmation Number:	7614
Title of Invention:	Single step, high temperature nucleation process for a lattice mismatched substrate
First Named Inventor/Applicant Name:	James R. Shealy
Customer Number:	23294
Filer:	Jennifer P. Yancy
Filer Authorized By:	
Attorney Docket Number:	CRF D-2759
Receipt Date:	08-DEC-2006
Filing Date:	02-MAR-2005
Time Stamp:	13:51:30
Application Type:	Utility

Payment information:

Submitted with Payment	yes
Payment was successfully received in RAM	$120
RAM confirmation Number	1525
Deposit Account	101213

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)	Multi Part /.zip	Pages (if appl.)

1	Amendment - After Non-Final Rejection	Shealy_11069040_Response_08Dec2006.pdf	16963	no	3
Warnings:					
Information:					
2	Extension of Time	Shealy_Transmittal_08Dec2006.pdf	18145	no	2
Warnings:					
Information:					
3	Fee Worksheet (PTO-875)	fee-info.pdf	8175	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	43283		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

PTO/SB/06 (12-04)
Approved for use through 7/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

Application or Docket Number: 11/0640

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))							300.00
SEARCH FEE (37 CFR 1.16(k), (l), or (m))							
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))							
TOTAL CLAIMS (37 CFR 1.16(i))	24 minus 20 =	* 4	x =		OR	x 50.00	200.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	* 0	x =			x =	
APPLICATION SIZE FEE (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))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	500.00

APPLICATION AS AMENDED – PART II

AMENDMENT A	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))							OR		
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))							OR		
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	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.

11/069040

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	11/069040	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2007/03/22 13:38
L2	2	("6218280").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2007/03/22 13:39
L3	1	"5625202".PN.	USPAT; USOCR	OR	OFF	2007/03/22 13:39
L4	1	"5385862".PN.	USPAT; USOCR	OR	OFF	2007/03/22 13:39
L5	1	"5341001".PN.	USPAT; USOCR	OR	OFF	2007/03/22 13:39
L6	1	"5300793".PN.	USPAT; USOCR	OR	OFF	2007/03/22 13:40
L7	1	"5274251".PN.	USPAT; USOCR	OR	OFF	2007/03/22 13:40
L8	1	"5162930".PN.	USPAT; USOCR	OR	OFF	2007/03/22 13:40
L9	1	"5006908".PN.	USPAT; USOCR	OR	OFF	2007/03/22 13:40
L10	1	"4792467".PN.	USPAT; USOCR	OR	OFF	2007/03/22 13:40
L11	1	"4221981".PN.	USPAT; USOCR	OR	OFF	2007/03/22 13:40
L12	1	"3857054".PN.	USPAT; USOCR	OR	OFF	2007/03/22 13:40

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Alexandria, Virginia 22313-1450
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NOTICE OF ALLOWANCE AND FEE(S) DUE

23294 7590 04/09/2007

JONES, TULLAR & COOPER, P.C.
P.O. BOX 2266 EADS STATION
ARLINGTON, VA 22202

EXAMINER	
NHU, DAVID	
ART UNIT	PAPER NUMBER
2818	

DATE MAILED: 04/09/2007

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/069,040	03/02/2005	James R. Shealy	CRF D-2759	7614

TITLE OF INVENTION: SINGLE STEP, HIGH TEMPERATURE NUCLEATION PROCESS FOR A LATTICE MISMATCHED SUBSTRATE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$300	$0	$1700	07/09/2007

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PTOL-85 (Rev. 07/06) Approved for use through 04/30/2007.

Qorvo - Exhibit 1002, Page 57

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

23294 7590 04/09/2007

JONES, TULLAR & COOPER, P.C.
P.O. BOX 2266 EADS STATION
ARLINGTON, VA 22202

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/069,040	03/02/2005	James R. Shealy	CRF D-2759	7614

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nonprovisional	NO	$1400	$300	$0	$1700	07/09/2007

EXAMINER	ART UNIT	CLASS-SUBCLASS
NHU, DAVID	2818	438-603000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

☐ Issue Fee

☐ Publication Fee (No small entity discount permitted)

☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

☐ A check is enclosed.

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

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. 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, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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.

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 NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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23294 7590 04/09/2007

JONES, TULLAR & COOPER, P.C.
P.O. BOX 2266 EADS STATION
ARLINGTON, VA 22202

EXAMINER	
NHU, DAVID	
ART UNIT	PAPER NUMBER
2818	

DATE MAILED: 04/09/2007

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 124 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 124 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 07/06) Approved for use through 04/30/2007.

Qorvo - Exhibit 1002, Page 59

Notice of Allowability	Application No.	Applicant(s)	
	11/069,040	SHEALY ET AL.	
	Examiner	Art Unit	
	David Nhu	2818	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *12/8/06*.

2. ☒ The allowed claim(s) is/are *1-24*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

REASONS FOR ALLOWANCE

1. Claims 1-24 are allowed.

2. The following is an examiner's statement of reasons for allowance: None of the references of record teaches or suggests as cited in claims 1, 18: pre-treating a surface of the substrate with at least one group III reactant or at least one group II reactant at an elevated growth temperature prior to introducing a group V reactant or a group VI reactant; introducing a group V reactant or a group VI reactant to grow a nucleation layer on the surface of the substrate; growing a buffer layer on said nucleation layer, said buffer layer providing a surface upon which said epitaxial layer is grown (as cited in claim 1); Pre-treating a surface of the substrate with at least a first group III reactant and a second group III reactant at a growth temperature of 900 to 1100^{o}C prior to introducing a nitrogen source; stopping a flow of the first group III reactant; introducing a nitrogen source to grow a nucleation layer on the surface of the substrate; resuming the flow of the first group III reactant and reducing a flow of the second group III reactant; stopping the flow of the second group III reactant; growing a buffer layer on said nucleation layer, said buffer layer providing a surface upon which said epitaxial layer is grown (as cited in claim 18).

3. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: Kryliouk et al (6,218,280 B1): Method and Apparatus for Producing Group III Intrides.

5. Any inquiry concerning this communication on earlier communications from the examiner should be directed to David Nhu , (571)272-1792. The examiner can normally be reached on Monday-Friday from 7:30 AM to 5:00 PM.

The fax phone number for the organization where this application or proceeding is assigned is (571)273-8300..

David Nhu

March 5, 2007

DAVID NHU
PRIMARY EXAMINER

Issue Classification	Application/Control No. 11/069,040	Applicant(s)/Patent under Reexamination SHEALY ET AL.
	Examiner David Nhu	Art Unit 2818

ISSUE CLASSIFICATION

ORIGINAL		INTERNATIONAL CLASSIFICATION	
CLASS	SUBCLASS	CLAIMED	NON-CLAIMED
438	603	H 01 L 21 /28	/
		H 01 L 21 /3205	/

CROSS REFERENCES					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
438	604	607			/ /
257	E21	097	E21	108	/ /
257	E21	112	E21	118	/ /
257	E21	126			/ /
					/ /

---------- (Assistant Examiner) (Date)	David Nhu 3/22/07 (Primary Examiner) (Date)	Total Claims Allowed: 24
G. Stanley 4-3-07 (Legal Instruments Examiner) (Date)		O.G. Print Claim(s): 1 / O.G. Print Fig.: 1

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	(1)		31		61		91		121		151		181
2	2		32		62		92		122		152		182
3	3		33		63		93		123		153		183
4	4		34		64		94		124		154		184
5	5		35		65		95		125		155		185
6	6		36		66		96		126		156		186
7	7		37		67		97		127		157		187
8	8		38		68		98		128		158		188
9	9		39		69		99		129		159		189
10	10		40		70		100		130		160		190
11	11		41		71		101		131		161		191
12	12		42		72		102		132		162		192
13	13		43		73		103		133		163		193
14	14		44		74		104		134		164		194
15	15		45		75		105		135		165		195
16	16		46		76		106		136		166		196
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	27		57		87		117		147		177		207
	28		58		88		118		148		178		208
	29		59		89		119		149		179		209
	30		60		90		120		150		180		210

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
11/069,040	SHEALY ET AL.
Examiner	**Art Unit**
David Nhu	2818

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

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Search Notes

Application/Control No.	Applicant(s)/Patent under Reexamination	
11/069,040	SHEALY ET AL.	
Examiner	**Art Unit**	
David Nhu	2818	

SEARCHED			
Class	Subclass	Date	Examiner
438	603	8/23/2006	DN
	604, 606		
	608, 688		
	660. 663		
	341, 363		
	416, 502		
	913		
	931, 933		

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
438	**603**	3/22/2007	**DN**
✓	604	✓	✓
✓	607	✓	✓

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
SEARCHED IN EAST	8/23/2006	DN
SEARCHED IN EAST	3/22/2007	DN

PART B - FEE(S) TRANSMITTAL

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23294 7590 04/09/2007

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(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Jones, Tullar & Cooper PC
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Cornell Research Foundation, Inc.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Ithaca, New York

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

☒ Issue Fee

☒ Publication Fee (No small entity discount permitted)

☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

☐ A check is enclosed.

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

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 10-1213 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature Jennifer P. Yancy Date June 26, 2007

Typed or printed name Jennifer P. Yancy Registration No. 47,003

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Electronic Patent Application Fee Transmittal

Application Number:	11069040
Filing Date:	02-Mar-2005
Title of Invention:	SINGLE STEP, HIGH TEMPERATURE NUCLEATION PROCESS FOR A LATTICE MISMATCHED SUBSTRATE
First Named Inventor/Applicant Name:	James R. Shealy
Filer:	Jennifer P. Yancy
Attorney Docket Number:	CRF D-2759
Filed as Large Entity	

Utility Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl issue fee	1501	1	1400	1400
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1700**

Electronic Acknowledgement Receipt	
EFS ID:	1913134
Application Number:	11069040
International Application Number:	
Confirmation Number:	7614
Title of Invention:	SINGLE STEP, HIGH TEMPERATURE NUCLEATION PROCESS FOR A LATTICE MISMATCHED SUBSTRATE
First Named Inventor/Applicant Name:	James R. Shealy
Customer Number:	23294
Filer:	Jennifer P. Yancy
Filer Authorized By:	
Attorney Docket Number:	CRF D-2759
Receipt Date:	26-JUN-2007
Filing Date:	02-MAR-2005
Time Stamp:	18:25:04
Application Type:	Utility

Payment information:

Submitted with Payment	yes
Payment was successfully received in RAM	$1700
RAM confirmation Number	2910
Deposit Account	101213
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 and 1.17	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	Shealy_Issue_Fee_Trans.pdf	82053	no	1
Warnings:					
Information:					
2	Fee Worksheet (PTO-06)	fee-info.pdf	8324	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	90377		

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/069,040	07/31/2007	7250360	CRF D-2759	7614

23294 7590 07/11/2007

JONES, TULLAR & COOPER, P.C.
P.O. BOX 2266 EADS STATION
ARLINGTON, VA 22202

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 124 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

James R. Shealy, Ithaca, NY;
Joseph A. Smart, Mooresville, NC;

CTL CENTER FOR TECHNOLOGY LICENSING AT CORNELL UNIVERSITY

395 Pine Tree Road, Suite 310
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Director of the US Patent and Trademark Office
PO Box 1450
Alexandria, VA 22313-1450

Re: USA Application 11/069,040, Patent 7,250,360;
Your Ref: 2759.01 US

Please note that the referenced patent(s) qualify as a SMALL entity.

Sincerely,

Date: February 16, 2015

Xiang Li
Interim Executive Director