

## CURRICULUM VITAE

### Dr. M. Arivanandhan

#### Associate Professor

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#### \* Education

Degree	Institution	Branch	Year	Class
Ph.D	Alagappa University, Karaikudi	Physics	2006	By thesis
M.Phil.,	Alagappa University, Karaikudi	Physics	2002	I Class (University III <sup>rd</sup> Rank)
M.Sc.,	Alagappa University, Karaikudi	Physics	2001	I Class with Distinction (University III <sup>rd</sup> Rank)
B.Sc.,	University of Madras, Chennai	Physics	1999	I Class

#### \* Professional experience

Position held	Institution	From	To	Nature of work
Associate Professor	<i>Centre for Nanoscience and Technology,</i> Anna University, Chennai	31 <sup>st</sup> Dec. 2014	Till date	Teaching and Research
Assistant Professor	<i>Department of Electronics and Materials Science,</i> <i>Graduate School of Engineering,</i> Shizuoka University, Hamamatsu, Japan	1 <sup>st</sup> April 2013	30th December, 2014	Teaching and Research
Assistant Professor	<i>Nanodevices Division,</i> RIE, Shizuoka University, Hamamatsu, Japan	1 <sup>st</sup> May, 2009	31 <sup>st</sup> March 2013	Teaching and Research
Postdoctoral Researcher	<i>Institute for Materials Research,</i> Tohoku University, Sendai, Japan	April, 2007	March, 2009	Research
Senior Research Associate	<i>Centre for Crystal Growth,</i> SSN College of Engineering, Chennai, India	Jan. 2006	March 2007	Research
Teaching Assistant	<i>Department of Physics,</i> Alagappa University, India	July 2002	May 2003	Teaching

### \* *Research Interest*

- ◆ *Thermoelectrics of bulk and nanomaterials*
- ◆ *Semiconductor nanostructures*
- ◆ *Silicon photovoltaics*
- ◆ *Physics of crystals and defects*
- ◆ *Crystal growth under Microgravity*

### \* *Research experience*

- ◆ Analysed the **first InGaSb** crystal grown at International Space Station (ISS).
- ◆ **Designed a system** to measure the thermoelectric properties of alloy semiconductors.
- ◆ **Developed a growth method** to grow **compositionally homogeneous SiGe** bulk crystal.
- ◆ **Proposed a novel method to suppress *Light induced degradation*** in B doped CZ-Si for high efficiency solar cells.
- ◆ Proposed a **defect reaction model** for Ga and Ge codoped CZ-Si.
- ◆ Studies on the correlation between *growth conditions and methods- defect structures of the materials –related functional properties*.
- ◆ **Long (500 mm) unidirectional organic crystal** has been grown by the novel method at ambient temperature.
- ◆ **Designed and fabricated a transparent Bridgman system** for organic crystal growth.
- ◆ A **Czochralski pulling system** based on thermal expansion of a metal - a feasibility investigation, especially for low growth rate crystals like pharmaceutical crystals.

### \* *Honors and Fellowships*

- **Grant-in-aid for Young Scientist C (2014-2016)** from MEXT, Government of Japan.
- **Grant-in-aid for Scientific Research B (2013-2015)** from MEXT, Government of Japan.
- Invited as a **Visiting Assistant Professor by Bharathidasan University**, India under the scheme of Inviting Renowned Professors of Foreign Universities, March 2013.
- **Designed a syllabus** for Electronic Engineering II: Physical Electronic devices, Shizuoka University.
- **Editorial Board member** of the Journal “Crystal Structure Theory and Applications” from August 2012 onwards.
- **Grant-in-aid for JSPS Young Scientist B (2010-2012)** from MEXT, Government of Japan.

- Certified as a **valued reviewer** by the Chief Editor of Journal of Crystal Growth.
- **Co-Investigator** of Japan's KIBO project at **International Space Station (2009-2014)**.
- **Invited speaker at several national and International conferences** in India, China, Mexico, Japan and US.
- **Reviewer** for the number of Journals including JCG, MCP, CrysEngComm, APL, JAP, APEX and so on.
- **COE Postdoctoral Fellowship** from IMR, Tohoku University, Japan 2007-2009.
- **University Research Fellowship**, Alagappa University, India, 2005.

### \* *Awards and Ranks*

- September 2014, **Young Researcher Award**, Inter Academia 2014, Riga, Latvia.
- March 2013, **Best Paper Award**, International Conference on Nanoscience and Nanotechnology (ICONN 2013), SRM University, Chennai, India.
- November, 2010, **Young Researcher Award**, AsiaNANO 2010- Asian Conference on Nanoscience & Nanotechnology, Tokyo, Japan.
- September, 2010, **Outstanding Poster Award**, 8<sup>th</sup> Japan-China-Korea workshop on Microgravity Sciences for Asian Microgravity pre-Symposium, Akiu, Sendai, Japan
- October 2009, **Encouragement Poster Award**, 24<sup>th</sup> Conference on Japan Society of Microgravity and Applications, Okinawa, Japan.
- December, 2005, **Best Research Paper award** in 2<sup>nd</sup> National Symposium on crystal growth of Laser related materials, India.
- January 2005, **Best Paper Award** in 10<sup>th</sup> National conference on Crystal Growth, India.
- May 2002, **University third Rank** in M.Phil Physics.
- May 2001, **University third Rank** in M.Sc Physics.
- June 2000, received **PMT-VOC Merit Scholarship** during M.Sc, *Alagappa University, India*.

### \* *Membership*

1. Life member of Indian Association for Crystal Growth (IACG).
2. Member of Japan Society of Applied Physics (JSAP).
3. Member of Japanese Society of Microgravity and Applications (JSMA).
4. Member of Japan Association for Crystal Growth (JACG).
5. Life member of Solar Energy Society of India (SESI).

## ***\*Conferences/Seminars/Workshop Organized***

**Organizing Committee/Session Chair/Scientific Advisory Committee Member of the following Programmes**

1. Session Chair “Silicon II-2”, 4<sup>th</sup> Asian Conference on Crystal Growth and Technology (CGCT-4), Sendai, Japan, May 2008.
2. Programme committee member, Global COE Young Scientist Meeting, Sendai, Japan, May, 2008.
3. International Organizing Committee Member, Collaborative Conference on Crystal Growth (3CG), Orlando, Florida, USA, December 11-14, 2012.
4. International Organizing Committee Member, Collaborative Conference on Crystal Growth (3CG), 10-13, June, 2013, Cancun, Mexico.
5. Advisory Committee Member, International Conference on Materials and Characterization techniques, VIT University, Vellore, Tamil Nadu, India, March, 10-12, 2014.

***Others - 16***

## ***\*Ph.D Guidance***

As a supervisor:

Completed- 1 (at MS University, India)

Title of Research: “**Investigation on the crystal growth and characterization of novel organic nonlinear optical materials**” (March 2013)

Ongoing - 3

As Co-supervisor:

Completed- 3 (at RIE, Shizuoka University, Japan)

## ***\* Publications***

- **Patents** 3
- **Book chapters** 2
- **Papers published in peer reviewed Journals** 105
- **Papers published in refereed Conference proceedings** 27
- **Papers presented in International conferences** 101
- **Papers presented in National conferences** 121
- **Invited talks** 25

### *\* List of patents*

1. Satoshi Uda, **M. Arivanandhan**, Raira Gotoh, Kozo Fujiwara, "High quality Silicon crystal and method for manufacturing the same" *Japan patent*, Application no. 2009- 064269, date: 17.3.2009; publication No.: 2010- 215455, date: 30.9.2010; Registration no.5419072, date: 2013.11.29.
2. Satoshi Uda, **M. Arivanandhan**, Raira Gotoh, Kozo Fujiwara, Y. Hayakawa "Crystalline Silicon and methods for producing single and polycrystalline Si ingots" *Japan patent*, Application no. 2011- 067402, date: 25.3.2011; publication No.: 2012-201551, date: 22.10.2012.
3. Y.Hayakawa, R.Arun Kumar, **M.Arivanandhan**, "Optical material and manufacturing method of optical material", *Japan patent application* JP2012000185575 (Filed), Aug. 24, 2012; publication date March 13<sup>th</sup> 2014, No. JP 2014043362 A.

### ❖ **Invited Book chapters**

1. "Direction Controlled Growth of Organic Single Crystals by Novel Growth Methods" **M. Arivanandhan**, V. Natarajan, K.Sankaranarayanan, Y.Hayakawa "Advanced Topics on Crystal Growth", InTech publication (Edited by Sukarno Ferreira), ISBN 978-953-51-1010-1 (2013) pp. 89-117.
2. "Compositionally homogeneous  $\text{Si}_{1-x}\text{Ge}_x$  and  $\text{Mg}_2\text{Si}_{1-x}\text{Ge}_x$  bulk crystals for thermoelectric applications" **M.Arivanandhan**, Y.Inatomi, Y.Hayakawa, "Recent Research Development on Crystal Growth" Transworld Research Network 6, 51-68; 2012, ISBN: 978-81-7895-568-1.

### *\* Selected papers*

1. "Effect of Erbium on the Photocatalytic Activity of  $\text{TiO}_2/\text{Ag}$  Nanocomposites under Visible Light Irradiation" Natarajan Prakash, Rajan Karthikeyan, Dheivasigamani Thangaraju, Mani Navaneethan, Mukannan Arivanandhan, Tadanobu Koyama, and Yasuhiro Hayakawa, **ChemPhysChem**, 16, (2015) 3084-3092.
2. "Growth of  $\text{In}_x\text{Ga}_{1-x}\text{Sb}$  alloy semiconductor at the International Space Station (ISS) and comparison with terrestrial experiments", Y. Inatomi, K. Sakata, M. Arivanandhan, G. Rajesh, V. Nirmal Kumar, T. Koyama, Y. Momose, T. Ozawa, Y. Okano and Y. Hayakawa, **Nature Partner Journal (npj) Microgravity**, in press, 2015.
3. "Facile Synthesis of graphene- $\text{CeO}_2$  Nanocomposites with enhanced electrochemical properties for Supercapacitors" T. Saravanan, M. Shanmugam, P. Anandan, M. Azhagurajan, K. Pazhanivel, M. Arivanandhan, Y.Hayakawa, R. Jayavel, **Dalton Transactions**, 44 (2015) 9901-9908.

4. "Segregation of Ge in B and Ge codoped CZ-Si Crystal Growth" ” M. Arivanandhan, R.Gotoh, K. Fujiwara, S. Uda, Y. Hayakawa, **Journal of Alloys and Compounds**, 639 (2015) 588-592.
5. "High power factor of Ga-doped compositionally homogeneous Si<sub>0.68</sub>Ge<sub>0.32</sub> bulk crystal grown by the vertical temperature gradient freezing method" M. Omprakash, M. Arivanandhan, T. Koyama, Y. Momose, H. Ikeda, H. Tatsuoka, D. K. Aswal, S. Bhattacharya, Y. Okano, T. Ozawa, Y. Inatomi, S. Moorthy Babu, and Y. Hayakawa, **Crystal Growth & Design**, 15 (2015) 1380-1388.
6. "Tailoring the bismuth telluride nanostructures by a scalable sintering process and its thermoelectric properties" P.Anandan, M.Omprakash, M.Azhagurajan, M.Arivanandhan, D.Rajan Babu, T.Koyama, Y.Hayakawa, **CrystEngComm**, 16 (2014) 7956-7962.
7. "Impact of Ge codoping on the enhancement of minority carrier lifetime in B-doped Czochralski –grown Si" Mukannan Arivanandhan, Raira Gotoh, Tatsuuro Watahiki, Kozo Fujiwara, Yashiro Hayakawa, Satoshi Uda, Makoto Konagai, **Journal of Applied Physics**, 111, 043707 (2012) .
8. "Chemical synthesis of ZnO hexagonal thin nanodisks and dye-sensitized solar cell performance" M. Navaneethan, J. Archana, M. Arivanandhan, Y. Hayakawa, **Physica Status Solidi RRL**, 6, 120-122 (2012).
9. "The effect of heavily Ge codoping on grown-in microdefects and photovoltaic characteristics of B doped CZ-Si" M. Arivanandhan, R.Gotoh, K. Fujiwara, S. Uda, Y. Hayakawa, and M.Konagai, **Scripta Materialia**, 69 (2013) 686-689.
10. "Anisotropy of hardness and laser damage threshold of unidirectional organic NLO crystal in relation to the internal structure", V. Natarajan, M. Arivanandhan, K. Sankaranarayanan, Y. Hayakawa, **Materials Chemistry and Physics**, 130 (2011) 154-158.
11. "The impact of Ge codoping on grown-in O precipitates in Ga doped Czochralski-silicon", Mukannan Arivanandhan, Raira Gotoh, Kozo Fujiwara, Tetsuo Ozawa, Yasuhiro Hayakawa, Satoshi Uda, **J. Crystal Growth** 321 (2011) 24-28.
12. "Growth of Si<sub>1-x</sub>Ge<sub>x</sub> bulk crystals with highly homogeneous composition for thermoelectric applications", M. Arivanandhan, Y. Saito, T. Koyama, Y. Momose, H. Ikeda, A. Tanaka, T.Tatsuoka, D.K. Aswal, Y. Inatomi, Y. Hayakawa, **J. Crystal Growth** 318, (2010) 324-327.
13. In-situ Observations of Dissolution Process of GaSb into InSb Melt by X-ray Penetration Method, G. Rajesh, M. Arivanandhan, H. Morii, T. Aoki, T. Koyama, Y. Momose, A. Tanaka, Y. Inatomi, Y. Hayakawa, **J. of Cryst. Growth**, 312 (2010) 2677-2682.

14. "High minority carrier lifetime in Ga and Ge codoped Czochralski-Silicon", M. Arivanandhan, Raira Gotoh, Kozo Fujiwara, Satoshi Uda, **Applied Physics Letters**, vol. 94, pp. 072102 (2009).
15. "Effects of B and Ge codoping on minority carrier lifetime in Ga doped Czochralski-Silicon", M. Arivanandhan, Raira Gotoh, Kozo Fujiwara, Satoshi Uda, **Journal of Applied Physics**, vol. 106, 013721 (2009).
16. "Directional growth of organic NLO crystal by different growth methods: A comparative study by means of XRD, HRXRD and laser damage threshold studies", M. Arivanandhan, Xinming Huang, Satoshi Uda, G. Bahavannarayana, N. Vijayan, K. Sankaranarayanan, P. Ramasamy, **J. Crystal Growth**, Vol. 310, Pages 4587-4592 (2008).
17. "Ga segregation in Czochralski-Si crystal growth with B codoping", Xinming Huang, M. Arivanandhan, Raira Gotoh, Takeshi Hoshikawa, Satoshi Uda, **J. Crystal Growth** Vol. 310, Pages 3335-3341 (2008).
18. "Growth of largest <100> oriented benzophenone single crystal from solution at ambient temperature", M. Arivanandhan, K. Sankaranarayanan, P. Ramasamy, **J. Crystal Growth**, Vol. 310, Pages 1493-1496 (2008).
19. "Melt growth of novel organic nonlinear optical material and its characterization", M. Arivanandhan, K. Sankaranarayanan, P. Ramasamy, **Materials Letters**, Vol. 61, Pages 4836-4838 (2007).
20. "Growth of Urea Doped Benzophenone Single Crystal for Non-Linear Optical Applications", M. Arivanandhan, C. Sanjeeviraja, K. Sankaranarayanan, S. K. Das, G. K. Samanta, P. K. Datta, **Optical Materials**, Vol. 28, Pages 324-330 (2006).
21. "Optical Frequency doubling in micro tube Czochralski ( $\mu$ T-CZ) grown benzophenone single crystals", M. Arivanandhan, K. Sankaranarayanan, C. Sanjeeviraja, A. Arulchakkaravarthi, P. Ramasamy, **Journal of Crystal Growth**, Vol. 281, Pages 596-603 (2005).
22. "Micro tube-Czochralski ( $\mu$ T-Cz) growth of bulk benzophenone single crystal for nonlinear optical applications", M. Arivanandhan, K. Sankaranarayanan, K. Ramamoorthy, C. Sanjeeviraja, P. Ramasamy, **Optical Materials**, Vol. 27, Pages 1864-1868 (2005).
23. "Highly textured ZnO thin films: a novel economical preparation and approachment for optical devices, UV lasers and green LEDs", K. Ramamoorthy, M. Arivanandhan, K. Sankaranarayanan and C. Sanjeeviraja, **Material Chemistry and Physics**, Vol. 85, Pages 257-262 (2004).

**\* Major Research Projects Completed/ongoing as Principal Investigator/Co-investigator**

No	Title of the project	Role in the project	Funding Agency	Duration		Total Outlay Rupees
				From	To	
1	"Alloy semiconductor crystal growth under microgravity at International Space Station"	Co-Investigator	Japan Aerospace Exploration Agency (JAXA), Japan.	2009	2014	13.5 Crore
2	"A novel way of preparation of high quality substrate material for highly efficient solar cells"	Principal Investigator	JSPS Grant-in aid for Young Scientist (B) from Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan.	2010	2012	33.8 Lakh
3	"Investigation on the effect of crystal orientation on solution growth of InGaSb and InGaAs compound semiconductors"	Co-Investigator	Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan.	2010	2013	1.5 Crore
4	"Growth of homogeneous SiGe alloy semiconductor for thermoelectric applications "	Co-Investigator	Indo-Japan Collaborative Research Project, funded by JSPS, Japan –DST, India.	2010	2012	33.8 Lakh
5	Fabrication of Tandem Structured Thermoelectric Devices using SiGe related alloy Semiconductors	Co-Investigator	Indo-Japan Collaborative Research Project, funded by JSPS, Japan –DST, India.	2012	2014	33.8 Lakh
6	Elucidation of the crystal growth and solute transport mechanism for the growth of high quality alloy semiconductor and fabrication of tandem thermoelectric cell	Co-Investigator	Grant-in-Aid for Scientific Research (B) from Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan.	2013	2015	1.2 Crore
7	Growth of high quality InGaSb crystal by controlling the convection	Co-Investigator	Grant-in-Aid for Scientific Research (B) from Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan.	2013	2015	1.3 Crore



8	Defect engineering in n-type Si by Ge doping for high efficiency solar cells	Principal Investigator	Grant-in-Aid for Scientific Research (C) from Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan.	2014	2016	35 Lakh
9	M.Tech Nanoscience and Technology	Co-Coordinator	DST-Nano Mission	2015	2021	4.85 Crore

***\*Minor Research Projects Completed/ongoing as Principal Investigator/Co-investigator***

No	Title of the project	Role in the project	Funding Agency	Duration		Total Outlay US\$
				From	To	
1	In-situ observation of crystal growth process of alloy semiconductors	Co-Investigator	Co-operative Research Project funded by Research Institute of Electronics	2009	2010	5.5 Lakh
2	In-situ observation of crystal growth process of alloy semiconductors	Co-Investigator	Co-operative Research Project funded by Research Institute of Electronics	2010	2011	5.5 Lakh
3	Preparation of high quality Si substrate material for highly efficient Solar cells	Principal Investigator	Inter-University Collaborative project with Tohoku University	2011	2012	3.0 Lakh
4	In-situ observation of semiconductor crystal growth process using X-ray image sensor	Co-Investigator	Co-operative Research Project funded by Research Institute of Electronics	2011	2012	5.5 Lakh
5	Growth of high quality Si crystal by adding Ge for photovoltaic application	Principal Investigator	Inter-University Collaborative project with Tohoku University	2012	2013	3.1 Lakh
6	Nano domain engineering in Bi <sub>2</sub> Te <sub>3</sub> and Sb <sub>2</sub> Te <sub>3</sub> nanocrystals for enhancing the thermoelectric characteristics	Principal Investigator	Research grant for Young Faculty, CTD, Anna University	2015	2016	0.5 Lakh