

# Ashish Garg – Curriculum Vitae

Department of Materials and Metallurgical Engineering &  
Samtel Center for Display Technologies  
Indian Institute of Technology Kanpur  
Kanpur 208016, INDIA

**Phone:** +91-512-2597904  
**Fax:** +91-512-2597505  
**Email:** a.garg.98@gmail.com  
ashishg@iitk.ac.in

## Personal Information

Born on 13th September 1973 in India; Male; Married; Indian National

## Professional Experience

- 05/2009 - Present Associate Professor, Department of Materials and Metallurgical Engineering  
Indian Institute of Technology Kanpur (IIT Kanpur)
- 04/2003 - 05/2009 Assistant Professor, Department of Materials and Metallurgical Engineering  
Indian Institute of Technology Kanpur (IIT Kanpur)
- 10/2001 - 03/2003 Research Fellow, Department of Materials Science and Metallurgy and Downing College  
University of Cambridge, UK
- 05/2002 - 10/2002 Process Engineer, Infineon Technologies, Dresden, Germany
- 08/1995 - 07/1996 Graduate Engineer, TATA SSL Ltd. (formerly Special Steels Ltd.), Mumbai, India

## Visiting Appointments

- 05-07/2005 University Research Fellow, University of Leeds, UK
- 09/2008-05/2009 Visiting Scientist, School of Applied Sciences, RMIT University, Melbourne, Australia

## Education

- 12/2001 PhD (Materials Science and Metallurgy), University of Cambridge, UK  
Thesis: Growth and structural-electrical-magnetic characterization of epitaxial oxide (ferroelectrics, superconductors, and manganites) thin films by PVD processes
- 01/1998 Master of Engineering (Metallurgy), Indian Institute of Science (IISc), Bangalore  
Thesis: Liquid phase sintering of Al-composites and Interface Characterization
- 06/1995 Bachelor of Engineering (Metallurgical Engineering), Visvesvaraya Regional College of  
Engineering, Nagpur, India (Now Visvesvaraya National Institute of Technology)

## Research Interests

- Thin film coatings and nanostructures of multifunctional compounds
- Device integration: sensors, thin film transistors and solar cells
- Materials synthesis by novel processing methods  
Structural and functional characterization of materials
- Structure-property correlations in ferroic oxides

## Entrepreneurial Activities

- Formed a materials technology startup company "CENOGEN MATERIALS PVT PTD.". The company is engaged in the sales and the development of variety of materials fabricated by novel patented low cost techniques and specialized equipments developed at IIT Kanpur. The company also provides consulting to the materials related problems to the industry.

## Research Grants Awarded (>INR 40 M)

1. "Field Effect Transistor Based on Epitaxial Multicomponent Oxide Heterostructures", Department of Science and Technology, Rs. 1,02,90,000/-, DST/MET/20090252
2. "Investigation on the effects of compositional modifications on structure and properties of BiFeO<sub>3</sub> thin films for device applications", Council for Scientific and Industrial Research, Rs. 13,49,000/-, CSIR /MET /20080187
3. "Functional Thin Film Nanostructures for Spintronics and Quantum Informatics", Ministry of Communication and Information Technology, Government of India, Rs. 2,32,000,00/-, DIT /PHY /20070143 (Co-investigator)
4. "Investigation of Multifunctional Ferroelectric (BiFeO<sub>3</sub>)<sub>x</sub>-(PbTiO<sub>3</sub>)<sub>1-x</sub> Thin Films for Sensor and Actuator Applications", Defence Research and Development Organization, Ministry of Defence, Government of India, Rs. 45,480,00/-, DRDO /MET /20060241

5. "Detailed Investigation into Ferroelectric Nanoceramics and Thin Films of Lanthanide Doped Bismuth Titanate for Device Applications", Department of Science and Technology, Government of India, New Delhi, 2006-2009, Rs. 34,80,000/-, DST /MET /20060216
6. Member of research grant on Printable Electronics: Large Area Organic Solar Cell Development; Supported by Department of Science and Technology, DST/R&D/20050036
7. 'Development of Novel Multifunctional Multiferroic Materials for Future Sensor and Actuator Technology' Ministry of Human Resources and Development (India), 2005-2008, Rs 15,00,000/-, MHRD/MET/20050072
8. 'Investigation of Aurivillius Phase Bi-Layered Oxides: Ferroelectric Ceramics and Thin Films for Non-volatile Ferroelectric Memory Applications, Grant No. SR/FTP/ETA-32/2002, Department of Science and Technology (India), 2003-2006, Rs 8,82,000 (**adjudged as excellent in the last review**)
9. 'Investigation of ferroelectric compounds and their thin films' Faculty Initiation Grant from Indian Institute of Technology Kanpur, Grant No: IIT-MME-20030108, 2003-2005, Rs 5,95,000 (Internal grant)

### **Major Awards and Fellowships**

- INSA (Indian National Science Academy) Young Scientist Award (2008)
- Young Scientist Award, Uttar Pradesh Council of Science and Technology, India (2007)
- Ramon y Kajal Fellowship, Ministry of Science and Technology, Spain (2007)
- Ramanna Fellowship, Department of Science and Technology, Government of India (2006)
- University Research Fellowship, University of Leeds, UK (2005)
- Sri Ram Arora Award for Materials Science Education, TMS Foundation, USA (2005)
- Independent Research Fellowship at Downing College, Cambridge (2001)
- Fellowship of Cambridge Philosophical Society, Cambridge (2000)
- Benefactors' Scholarship (during PhD), St. John's College, Cambridge (1998)
- Honorary Cambridge Commonwealth Scholar, Cambridge Commonwealth Trust, Cambridge (1998)
- Overseas Research Students Award, UK (1998)
- A.K. Bose Gold Medal for the best MEng thesis in metallurgy in India (1998)

### **Developmental Activities**

- Development of a dedicated thin film and coatings research laboratory with facilities for thin film growth by spin coating, evaporation and pulsed laser ablation, dielectric and ferroelectric testing facilities, transport measurements, temperature dependent measurements, chemical wet benches etc.
- Lead role in setting up high resolution X-ray diffraction, scanning electron microscope, and atomic force microscope facilities under Nano Science and Technology Initiative of DST.

### **Professional Recognition**

- Reviewer for international journals
- Reviewer for research proposals from government agencies
- Session chair and invited speaker at various international conferences

### **Teaching Interests**

- Graduate as well as Undergraduate teaching on Electronic and Magnetic Materials and Devices, Introductory Materials Science, Electronic and Magnetic Materials, Diffusion, and Oxide Ceramics, and Thin Film Growth.

### **Thesis Guidance**

Doctoral: 3 (under progress), Masters: 12 (Completed), Undergraduate: 16 (Completed)

## Patents

1. "Low temperature Synthesis of Nd-doped Bismuth Titanate Nanoparticles" Indian Patent Appl. No. 804/DEL/2007 (Co-inventors: P. Prakash, M.K. Roy and H.C. Verma)
2. "Room Temperature Synthesis of Nanocrystalline Hydroxyapatite Ceramics", Indian Patent Appl. No. 828/DEL/2008 (Co-inventors: T. Mandal and B.K. Mishra)
3. "Large ferroelectricity in chemical solution processed BiFeO<sub>3</sub>-PbTiO<sub>3</sub> thin films for high temperature sensors, Indian Patent Application No. 1198/DEL/2008 (Co-inventors: S. Kar, D.C. Agrawal, D. Pandey)

## Refereed Publications

### 2009

1. S. Bhargava, **A. Garg** and D. Subasinghe, In-situ High-Temperature Phase Transformation Studies on Pyrite, *Fuel*, 88, 988–993 (2009)
2. D. Maurya, K.S. Nalwa, H. Thota and **A. Garg**, BiFeO<sub>3</sub> Ceramics Synthesized by Mechanical Activation Assisted vis-à-vis Conventional Solid-State-Reaction Process: A Comparative Study, *Journal of Alloys and Compounds*, 477 (2009) 780–784
3. A. Srivastava, **A. Garg** and F.D. Morrison, Impedance Spectroscopy Studies on Polycrystalline BiFeO<sub>3</sub> Thin Films on Pt/Si Substrates, *Journal of Applied Physics*, 105, 054103 (2009)
4. S. Gupta, **A. Garg**, D.C. Agrawal, S. Bhattacharjee, and D. Pandey, Structural Changes and Ferroelectric Properties of BiFeO<sub>3</sub>-PbTiO<sub>3</sub> Thin Films Grown via a Chemical Multilayer Deposition Method, *Journal of Applied Physics*, 105, 014101 (2009) (*Among 20 most downloaded papers in January 2009*)
5. A. Solanki, A. Gupta, S.S.K. Iyer and **A. Garg**, Photovoltaic Effect in Organic Solar Cell Device using AVPV, *Solar Energy Materials and Solar Cells*, 93, 211–214 (2009)
6. D. Maurya, H. Thota, **A. Garg**, B. Pandey, P. Chand, and H.C. Verma, Magnetic Studies on Multiferroic Bi<sub>1-x</sub>Sm<sub>x</sub>FeO<sub>3</sub> Ceramics Synthesized by Mechanical Activation Assisted Process, *Journal of Physics C: Condensed Matter* 21, 026007 (2009)

### 2008

7. H. Thota, **A. Garg**, B. Pandey and H.C. Verma, Effect of Cooling Conditions on the Magnetic Structure of Multiferroic BiFeO<sub>3</sub> Synthesized by Mechanical Activation, *Hyperfine Interactions* 187, 81–86 (2008)
8. **A. Garg**, S. Kar, D.C. Agrawal, S. Bhattacharjee, D. Pandey, Existence of Large Room Temperature Ferroelectricity in Chemical Solution Grown PbTiO<sub>3</sub> Buffered (BiFeO<sub>3</sub>)<sub>1-x</sub>-(PbTiO<sub>3</sub>)<sub>x</sub> Films on Pt/Si Substrates, arXiv:0804.1611v1 [cond-mat.mtrl-sci] (2008)
9. S. Pattnaik, **A. Garg**, and M. Katiyar, Organic Field Effect Transistor using BaTiO<sub>3</sub>-Mn Doped and P(VDF-TrFE) for Non Volatile Memory Applications, *Materials Research Society Symposium Proceedings*, 1071, 1071-F03-10, 161-165 (2008)
10. V.R. Singh, **A. Garg** and D. C. Agrawal, Structural Changes in Chemical Solution Deposited Lanthanum Doped Bismuth Ferrite Thin Films, *Applied Physics Letters*, 92, 152905 (2008)
11. M. Kumar, **A. Garg**, R. Kumar, M.C. Bhatnagar, Structural, dielectric and ferroelectric study of Ba<sub>0.9</sub>Sr<sub>0.1</sub>Zr<sub>x</sub>Ti<sub>1-x</sub>O<sub>3</sub> ceramics prepared by the sol gel method, *Physica B*, 403, 1819-1823 (2008)
12. A. Shrinagar, **A. Garg**, R. Prasad and S. Auluck, Phase Stability in Ferroelectric Bismuth Titanate: A First Principles Study, *Acta Crystallographica*, A64, 368–375 (2008)
13. V.R. Singh, A. Dixit, D.C. Agrawal and **A. Garg**, Synthesis and Characterization of Multiferroic BiFeO<sub>3</sub> Thin Films Prepared by Chemical Solution Deposition Method, *Indian Journal of Engineering and Materials Science*, 15, 104-106 (2008)
14. K. Singh, **A. Garg** and A. Upadhyaya, Characterization of Multiferroic BiFeO<sub>3</sub> Ceramics synthesized by Solid-State-Reaction Method, *Indian Journal of Engineering and Materials Science*, 15, 91-94 (2008)
15. K.S. Nalwa and **A. Garg**, Phase Evolution, Magnetic and Electrical Properties in Sm-doped Bismuth Ferrite, *Journal of Applied Physics*, 103, 044101 (2008)
16. V.R. Singh, **A. Garg**, A. Dixit, and D.C. Agrawal, Effect of Heat Treatment on Structure and Properties of Chemical Solution Deposited BiFeO<sub>3</sub> Thin Films, *Applied Physics A*, 90, 197-202 (2008)
17. K.S. Nalwa, **A. Garg**, A. Upadhyaya, Effect of Samarium Doping on the Properties of Solid-State-Synthesized Multiferroic Bismuth Ferrite, *Materials Letters* 62, 878–881 (2008)

### 2007

18. R. K. Singh, **A. Garg**, R. Bandyopadhyaya and B. K. Mishra, Density Fractionated Hollow Silica Microspheres with High-Yield by Non-Polymeric Sol-Gel/Emulsion Route; *Colloids and Surfaces A: Physicochem. Eng. Aspects* 310, 39–45 (2007)
19. K.S. Nalwa, **A. Garg** and A. Upadhyaya, *Transactions of PMAI*, 33, 79-82 (2007)
20. **A. Garg**, T. Harikishan, B. Pandey, H. C. Verma, Investigation of Magnetic Behavior of Mechanical Activation Derived Multiferroic BiFeO<sub>3</sub>, *Materials Research Society Symposium Proceedings*, 997, 0997-I08-07, 255-260 (2007)
21. **A. Garg**, S. Kar, A. Dixit, M. Pushkar, D.C. Agrawal, Sol-gel Synthesis and Characterization of Multiferroic BiFeO<sub>3</sub>-PbTiO<sub>3</sub> Thin Films, *Materials Research Society Symposium Proceedings*, 997, 0997-I08-08, 267-271 (2007)

22. P. Prakash, M.K. Roy, **A. Garg** and H.C. Verma, Novel Low Temperature Processing and Characterization of Ferroelectric Bismuth Titanate Nanopowders, *Journal of American Ceramic Society*, 90 (4), 1295-1298 (2007) (**Highlighted by MRS Bulletin, July 2007 issue**)
23. A.K. Agarwal, **A. Garg**, D. Srivastava and M.K. Shukla, Investigation into wear characteristics of hard coated stainless steel rings for automobile applications, *Surface Coatings and Technology*, 201 (13) 6182-6188 (2007)
24. S. Pramanik, A.K. Agarwal, K.N. Rai and **A. Garg**, Development of High Strength Hydroxyapatite by Solid-State-Reaction Process, *Ceramics International*, 33 (3), 419-426 (2007)
- 2006**
25. M.K. Shukla, A.K. Agarwal and **A. Garg**, Preliminary investigation into comparative performance of titanium based coatings for automotive applications using biodiesel blend and diesel, *Proceedings of the Spring Technical Conference of the ASME Internal Combustion Engine Division*, 727-733 (2006)
26. **A. Garg**, X. Hu and Z.H. Barber, Lanthanide Doped Bismuth Titanate Films Grown by Chemical Solution Deposition and Pulsed Laser Ablation: A Comparison, *TMS Letters*, 3 (2), 35-36 (2006)
27. M.A. Khan, **A. Garg**, and A.J. Bell, Pulsed laser deposition and characterization of  $(\text{BiFeO}_3)_{0.7}\text{-(PbTiO}_3)_{0.3}$  thin films, *J. Phys.* 26, 288-291 (2006)
28. X. Hu, **A. Garg** and Z.H. Barber, Deposition and Characterization of Pulsed-Laser-Deposited and Chemical-Solution-Derived Sm-Substituted Bismuth Titanate Films, *Integrated Ferroelectrics*, 79, 113-121 (2006)
- 2005**
29. **A. Garg**, X. Hu. and Z.H. Barber, Structure and Properties of Lanthanide Doped  $\text{Bi}_4\text{Ti}_3\text{O}_{12}$  Films, *Ferroelectrics*, 328, 93-97 (2005)
30. X.Hu, **A. Garg** and Z.H. Barber, Growth and characterization of pulsed-laser-deposited polycrystalline  $\text{Bi}_{3.33}\text{Sm}_{0.67}\text{Ti}_3\text{O}_{12}$  ferroelectric thin films, *Materials Letters*, 59, 2583 – 2587 (2005)
31. X.Hu, **A. Garg** and Z.H. Barber, Structural and electrical properties of Samarium-substituted bismuth titanate ferroelectric thin films on Pt/ $\text{TiO}_x$ / $\text{SiO}_2$ /Si substrates, *Thin Solid Films*, 484, 188-195 (2005)
- 2004**
32. **A. Garg**, A. Snedden, P. Lightfoot, X. Hu, J.F. Scott, and Z.H. Barber, Pulsed Laser Deposition and Characterization of Nd-doped  $\text{Bi}_4\text{Ti}_3\text{O}_{12}$  Thin Films, *Ferroelectrics*, 313, 15-20 (2004)
33. **A. Garg**, A. Snedden. P. Lightfoot, J.F. Scott, X. Hu, and Z.H. Barber, Investigation of Structural and Ferroelectric Properties of Pulsed-Laser-Ablated Epitaxial Nd-Doped Bismuth Titanate Films, *J. Appl. Phys.*, 96, 3408-3412 (2004)
34. W.S. Toh, **A. Garg**, J. M. Xue, J. Wang, Z. H. Barber and J. E. Evetts, Ferroelectric Behaviors of W-doped  $\text{SrBi}_2\text{Ta}_2\text{O}_9$  Thin Films, *Integrated Ferroelectrics*, 62,163-169 (2004)
35. X.B. Hu, **A. Garg**, J. Wang, and Z.H. Barber, Ferroelectric  $\text{Bi}_{4-x}\text{Sm}_x\text{Ti}_3\text{O}_{12}$  Thin Films Fabricated by Pulsed Laser Deposition for NV-RAM Applications, *Integrated Ferroelectrics*, 61, 123-127 (2004)
- 2003**
36. M. Kempa, P. Kuzel, S. Kamba, P. Samoukhina, J. Petzelt, **A. Garg** and Z. H. Barber, Ferroelectric Soft Mode and Central Mode in  $\text{SrBi}_2\text{Ta}_2\text{O}_9$  Films, *J. Phys. C: Condens. Matter*, 15, 8095–8102 (2003)
37. **A. Garg**, Z.H. Barber, M. Dawber, J.F. Scott, A. Snedden, and P. Lightfoot, Orientation Dependence of Ferroelectric Properties of Pulsed Laser Ablated  $\text{Bi}_{4-x}\text{Nd}_x\text{Ti}_3\text{O}_{12}$  Films, *Applied Physics Letters*, 83 (12 ), 2414-2416 (2003)
38. Z.H. Barber, C. Christou, K.-F. Chiu and **A. Garg**, The measurement and control of ionization of the depositing flux during film growth, *Vacuum*, 69 (1-3), 56-62 (2003)
- 2000-2002**
39. **A. Garg**, S. Lloyd, and Z.H. Barber, Epitaxial growth of completely a-/b-axis oriented  $\text{SrBi}_2\text{Ta}_2\text{O}_9$  films, *Integrated Ferroelectrics*, 44, 1-8 (2002)
40. S. Kamba, J. Pokorný, V. Porokhonsky, J. Petzelt, M. P. Moret, **A. Garg** and Z. H. Barber, and R. Zallen, New ferroelastic phase in  $\text{SrBi}_2\text{Ta}_2\text{O}_9$  and study of the ferroelectric phase-transition dynamics, *Applied Physics Letters*, 81 (6), 1056 (2002)
41. **A. Garg** and Z. H. Barber, Pulsed laser deposition of epitaxial  $\text{SrBi}_2\text{Ta}_2\text{O}_9$  films with controlled orientation, *Ferroelectrics*, 268, 89 (2002)
42. C. Christou, **A. Garg** and Z. H. Barber, Vapor-Phase Oxidation During Pulsed Laser Deposition of  $\text{SrBi}_2\text{Ta}_2\text{O}_9$ , *Journal of Vacuum Science and Technology-A*, 19 (5), 2061 (2001)
43. **A. Garg**, S. Dunn, and Z. H. Barber, Growth and Characterization of Epitaxial  $\text{SrBi}_2\text{Ta}_2\text{O}_9$  films on  $\text{SrTiO}_3$  (110) Substrate, *Integrated ferroelectrics*, 31 (1-4), 13 (2000)
44. **A. Garg**, J. A. Leake, and Z. H. Barber, Epitaxial Growth of  $\text{WO}_3$  Films on  $\text{SrTiO}_3$  and R-Sapphire, *J. Physics: D, Applied Physics*, 33 (9), 1048 (2000)

### Conference Proceedings

45. **A. Garg** and H. Thota, Phase Evolution and Properties of Mechanochemically Synthesized Multiferroic Bismuth Ferrite Ceramics, *Proceedings of International Conference on Materials for Advanced Technologies (Symposium on Materials for Advanced Sensors and Detectors)*, eds. G.M. Kale, 1-6 July 2007, Singapore

46. V.R. Singh, S. Pandey, **A. Garg**, A. Dixit, and D.C. Agarwal, Effect of Heat Treatment on Structure and Properties of Chemical Solution Processed Multiferroic La-Doped BiFeO<sub>3</sub> Thin Films, Proceedings of International Conference on Materials for Advanced Technologies (Symposium on Materials for Advanced Sensors and Detectors), eds. G.M. Kale, 1-6 July 2007, Singapore
47. K.S. Nalwa, **A. Garg** And A. Upadhyaya, Synthesis and Characterization Sm-Doped BiFeO<sub>3</sub> Ceramics, Proceedings of International Conference on Materials for Advanced Technologies (Symposium on Materials for Advanced Sensors and Detectors), eds. G.M. Kale, 1-6 July 2007, Singapore
48. T. Harikishan and **A. Garg**, Multiferroic Bismuth Ferrite Synthesized by Mechanical Activation, Proceedings of 14<sup>th</sup> National Symposium on Ferroelectrics and Dielectrics, IIT Kharagpur, Dec 18 - 21, 2006, (MacMilan India Publishing Co., New Delhi), MS-002.
49. **A. Garg**, X-ray Diffraction for Materials Characterization, Proceedings of Workshop on "Analytical Instrumental Techniques: Current Trends and Practices", Regional Research Laboratory, Bhubaneswar, 20-23 June 2006
50. **A. Garg**, X. Hu and Z.H. Barber, Detailed Comparison of Lanthanide Doped Bismuth Titanate Films Grown by Chemical Solution Deposition and Pulsed Laser Ablation, TMS Letters, 3(2), 35-36 (2006), Proceedings of TMS Annual Meeting 2006, 12-16 March 2006, San Antonio (USA)
51. U. Kumar, S. Kumar and **A. Garg**, Investigation into Structural and Morphological Characterization of Samarium Doped Bismuth Titanate (Bi<sub>4-x</sub>Sm<sub>x</sub>Ti<sub>3</sub>O<sub>12</sub>) Thin Films, in the proceedings of ICAMDD 2005 (International Conference on Advanced Materials Design & Development), Goa, 14-16<sup>th</sup> December 2005, pp480485, Elsevier
52. X. Hu, **A. Garg**, Z.H. Barber, J.F. Scott, A. Snedden and P. Lightfoot, Deposition and Characterisation of bismuth-layered perovskite ferroelectric thin films, IOM (London) proceedings (2005)
53. K. Dutta, **A. Garg**, S. Sangal, B.K. Mishra, P. Vankar, and P. K. Rohatgi, A Characterization Study to Ascertain Cenosphere Content in Fly Ash, In 'Emerging Trends in Mineral Processing and Extractive Metallurgy', Eds: Vibhuti N. Mishra, S.C. Das and T. Subbaiah, Allied Publishers (2005)
54. **A. Garg** and Z. H. Barber, Growth of Extremely Smooth Epitaxial SrBi<sub>2</sub>Ta<sub>2</sub>O<sub>9</sub> films on SrTiO<sub>3</sub> Substrates, Workshop proceedings of the Ferroelectrics 2000 UK, eds. Neil Alford and Eric Yeatman, 11-14 April 2000, Cirencester, UK (an IOM Communications publication)