

Zheng Gai
R&D Staff
Center for Nanophase Materials Sciences
Material Sciences and Technology Division
Oak Ridge National Laboratory
(865) 574-1648
gaiz@ornl.gov



Education

Peking University, Beijing, China	Surface Science	Ph.D.	1995
Peking University, Beijing, China	Condensed Matter Physics	B.S.	1989

Professional Experience

2005/8 - Present	R&D Staff Scientist, Center for Nanophase Materials Sciences and Material Science and Technology Divisions, Oak Ridge National Laboratory
2000/5 – 2005/8	Professor, Physics Department, Peking University, Beijing, P. R. China
2004/5 – 2005/8	Visiting Professor, Max Planck Institute of Microstructure Physics, Halle, Germany
2000/12 – 2003/12	Visiting Scientist, Low-Dimensional Materials by Design Group, Condensed Matter Sciences Division, Oak Ridge National Laboratory, USA
1997/8 – 2000/12	Associate Professor, Physics Department, Peking University, Beijing, P. R. China.
1998/7 – 1999/9	Visiting Scientist, Institute for Materials Research, Tohoku University, Japan.
1997/3 – 1997/5	Visiting Scientist, Department of Material Science, State University of New York, Stony Brook, USA.
1995/7 – 1997/7	Postdoctoral Fellow, Physics Department, Peking University, Beijing, P. R. China.

Professional and Synergistic Activities

2010-present	Member and Review Panel of Center for Functional Nanomaterials at Brookhaven National Laboratory.
2008-present	Chair-Elect, Treasurer and Executive Committee, Magnetic Interface and Nanostructure Division, American Vacuum Society
2001-present	Member: Materials Research Society, American Vacuum Society, and American Physical Society

Significant Awards and Honors

- Outstanding Doctoral Thesis Award, Education Ministry, P. R. China, 1999
- Award for Progress in Science and Technology (2nd grade), Education Ministry, P. R. China, 1998
- Hu Gangfu Physics Award, Chinese Association of Physics, 1997
- Award for Progress in Science and Technology (1st grade), Education Ministry, P. R. China, 1996
- Outstanding Doctoral Thesis Award, Chinese Vacuum Society, 1995

Publications (Over 69 peer-reviewed papers) Full publication list follows CV.

Research Synopsis

1. *Ferromagnetic films with broken inversion symmetry: discovery of emergent phenomena and new forms of order.* We grow ferromagnetic films with broken inversion symmetry using MBE, study the novel helical magnetic structure using SEMPA, SPM and MPMS.
2. *Complex Oxides films: correlation between local and global electronic structures.* We grow complex oxides films using PLD, and study the temperature dependence of the local electronic structure using in-situ STM, the results are compared with global magnetic and transport properties to understand the underneath physics.
3. *Property tuning of complex oxides films.* We tune the metal-insulator transitions of complex oxides films using surface exchange coupling with magnetic nanodots, lateral confinements, substrate induced strains, and oxygen overlayer.
4. *Nanomagnetism:* We study the magnetic exchange coupling of nanomaterials (0D dots, 1D wires, 2D films, and quasi 3D dots superlattices) using SEMPA, SMOKE, SPM and MPMS.
5. *Organic molecules on surfaces:* We study the adsorption of organic molecules on metal surfaces using SPM to understand the structure and electronic properties of the assemblies.
6. *Self-assembly of nanomaterials:* We develop novel methods to in-situ grow nanodots arrays with uniform size, composition, orientation and order.

Thesis Advisor and Postgraduate-Scholar Sponsor:

Past Ph.D. Students

X. W. Tu (Peking University), Lu Chi (Peking University), Lei Zhang (Peking University), Kenji Fuchigami (University of Tennessee) (with Jian Shen), Min Gao (Institute of Physics, Chinese Academy of Sciences)

Current Ph.D. Students

Jieyu Yi (University of Tennessee, with David Mandrus)

Postdoctoral Associates

Lan Gao, Deyong Wang, Lifeng Yin

PUBLICATIONS

Zheng Gai, Ph.D.

R&D Staff

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Oak Ridge National Laboratory

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gaiz@ornl.gov

1. "Magnetic and pH dual responsive core-shell hybrid nanogels: a single nano-object for pH-dependent magnetic manipulation, fluorescent pH-sensing, and drug delivery", Weitai Wu, Jing Shen, **Zheng Gai**, Kunlun Hong, Probal Banerjee, and Shuiqin Zhou, *Biomaterials* (in press).
2. "Tuning the metal-insulator transition in manganite films through surface exchange coupling with magnetic nanodots", T.Z. Ward, **Zheng Gai**, X.Y. Xu, H.W. Guo, Lifeng Yin, and J. Shen, *Phys. Rev. Lett.* 157207 (2011).
3. "Dynamics of a first order electronic phase transition in manganites", T.Z. Ward, **Zheng Gai**, H.W. Guo, Lifeng Yin, and J. Shen, *Phys. Rev. B*, 83, 125125 (2011).
4. "Coverage dependence of magnetic domain structure and magnetic anisotropy in supported Fe nanoparticles on Al₂O₃/NiAl(100)", Wen-Chin Lin, C.B. Wu, J. Hsu, H.Y. Yen, **Zheng Gai**, Lan Gao, Jian Shen, and Minn-Tsong Lin, *J. Appl. Phys.* 108, 034312 (2010).
5. "Giant magnetoresistance in organic spin valves", Dali Sun, Lifeng Yin, Chengjun Sun, Hangwen Guo, **Zheng Gai**, X.-G. Zhang, T. Z. Ward, Zhaohua Cheng, and Jian Shen, *Phys. Rev. Lett.* 104, 236602 (2010).
6. "Tuning the ferromagnetic coupling of Fe nanodots on Cu(111) via dimensionality variation of the mediating electrons", Lifeng Yin, Di Xiao, **Zheng Gai**, T.Z. Ward, N. Widiaia, G.M. Stocks, Z.H. Cheng, E.W. Plummer, Z.Y. Zhang, and J. Shen, *Phys. Rev. Lett.* 104, 167202 (2010).
7. "Elastically-Driven Anisotropic Percolation in Electronic Phase-Separated Manganites", T.Z. Ward, J.D. Budai, **Zheng Gai**, J.Z. Tischler, Lifeng Yin, and J. Shen, *Nature Physics*, 5, 885 (2009).
8. "Magnetic interaction in Fe nanoparticle assemblies studied by scanning electron microscopy with polarization analysis", Wen-Chin Lin, **Zheng Gai**, Lan Gao, Jian Shen, Pin-Jui Hsu, Hong-Yu Yen, and Minn-Tsong Lin, *Phys. Rev. B* 80, 024407 (2009).
9. "Tunable Metallicity of the La_{5/8}Ca_{3/8}MnO₃(001) Surface by an Oxygen Overlayer", K. Fuchigami, **Zheng Gai**, T. Z. Ward, L. F. Yin, P.C. Snijders, E. W. Plummer, and J. Shen, *Phys. Rev. Lett.* 102, 066104 (2009).
10. "Response to 'Comment on 'Magnetization reversal in europium sulfide nanocrystals'" [*Appl. Phys. Lett.* 91, 026102 (2007)]", Marcela L. Redigolo, Dmitry S. Koktysh, Sandra J. Rosenthal, James H. Dickerson, L. Gao, **Z. Gai** and J. Shen, *Appl. Phys. Lett.* 92, 026103 (2008).

11. "Direct Synthesis and Size Selection of Ferromagnetic FePt Nanoparticles", Matthew S. Wellons, William H. Morris, III, **Zheng Gai**, Jian Shen, James Bentley, James E. Wittig, and Charles M. Lukehart, *Chem. Mater.* 19, 2483 (2007).
12. "Magnetization reversal in europium sulfide nanocrystals", Marcela L. Redígolo, Dmitry S. Koktysh, Sandra J. Rosenthal, James H. Dickerson, L. Gao, **Z. Gai** and J. Shen, *Appl. Phys. Lett.* 89, 222501 (2006).
13. "Formation of FePt Nanoparticles Having Exceptionally High Coercivity", Ryan D. Rutledge, William H. Morris, Matthew S. Wellons, **Zheng Gai**, Jian Shen, J. Bentley, James E. Wittig, and Charles M. Lukehart, *J. Am. Chem. Soc.* 128, 14210 (2006).
14. "Frozen low-spin interface in ultrathin Fe films on Cu(111)", M.A. Torija, **Z. Gai**, N. Myoung, E.W. Plummer, J. Shen, *Phys. Rev. Lett.* 95, 027201 (2005).
15. "Self-Assembled two-dimensional alloy FePt nanodot arrays with mono-dispersion and orientation", **Zheng Gai**, J.Y. Howe, J.D. Guo, D.A. Blom, E.W. Plummer, and J. Shen, *Appl. Phys. Lett.* 86, 023107 (2005).
16. "Ferromagnetic Stability in Fe Nanodot Assemblies on Cu(111) Induced by Indirect Coupling through the Substrate", J. P. Pierce, M.A. Torija, **Z. Gai**, J.R. Shi, T.C. Schulthess, G.A. Farnan, J. F. Wendelken, E.W. Plummer, and J. Shen, *Phys. Rev. Lett.* 92, 237201 (2004).
17. "Growth and magnetism of metallic thin films and multilayers by pulsed laser deposition", J. Shen, **Zheng Gai**, and J. Kirschner, *Surf. Sci. Rep.* 52, 163 (2004). (invited review paper)
18. "Study of In/Si stable surfaces by LEED", W.J. Li, J.L. Jiang, **Z. Gai**, R.G. Zhao, W.S. Yang, *Acta Physica Sinica* 53, 521 (2004)
19. "Electronic Stability of Magnetic Fe/Co Superlattices with Monoatomic Layer Alternation", G.A. Farnan, C. L. Fu, **Z. Gai**, M. Krcmar, A.P. Baddorf, Z.Y. Zhang, and J. Shen, *Phys. Rev. Lett.* 91, 226106 (2003).
20. "High-yield solvothermal formation of magnetic FePt alloy nanowires", Z. Zhang, D.A. Blom, **Zheng Gai**, J. Thompson, J. Shen, and S. Dai, *J. Am. Chem. Soc.* 125, 7528 (2003).
21. "Self-assembly of nanometer-scale magnetic dots with narrow size distributions on an insulating substrate", **Zheng Gai**, Biao Wu, J. P. Pierce, G.A. Farnan, D.J. Shu, M. Wang, Zhenyu Zhang, and J. Shen, *Phys. Rev. Lett.* 89, 235502 (2002).
22. "Adsorption geometry of glycine on Cu(001) determined with low-energy electron diffraction and scanning tunnelling microscopy", Ge SP, Zhao XY, **Zheng Gai**, Zhao RG, Yang WS, *Chinese Phys.* **11**, 839 (2002).
23. " Nanofaceting of unit cells and temperature dependence surface reconstruction and morphology of Si(105)and (103)", R.G. Zhao, **Zheng Gai**, Wenjie Li, Jinlong Jiang, Y. Fujikawa, T. Sakurai, and W.S. Yang, *Surf. Sci.* 517, 98 (2002).
24. "Growth of low dimensional magnetic nanostructures on an insulator", **Zheng Gai**, G.A. Farnan, J. Pierce, and J. Shen, *Appl. Phys. Lett.* 81, 742, (2002).

25. "Monte Carlo simulations of interacting magnetic nanoparticles", H.K. Lee, T.C. Shulthess, D.P. Landau, G. Brown, J. Pierce, **Z. Gai**, G. Farnan, and J. Shen, *J. Appl. Phys.* 91, 6926 (2002).
26. "Atomic structure of the Ge(112)-(4 x 1) - In reconstruction", XW Tu and **Zheng Gai**, *Acta Physica Sinica*, 50, 2439 (2001).
27. "Adsorption behavior of amino acids on copper surfaces ", Xueying Zhao, H. Wang, H. Yan, **Zheng Gai**, R.G. Zhao, and W.S. Yang, *Chinese Phys.* 10, S84 (2001).
28. "A major stable surface of silicon: Si(20 4 23)", **Zheng Gai**, R.G. Zhao, Y. Fujikawa, T. Sakurai, and W.S. Yang, *Phys. Rev. B.* 64, 125201 (2001).
29. "Si(313)12×1: another metallic major stable surface of silicon with a thick and complex reconstructed layer", **Zheng Gai**, R.G. Zhao, T. Sakurai, and W.S. Yang, *Phys. Rev. B* 63, 085301 (2001).
30. "Atomic structures and dynamic processes of Ge and Si surfaces", W.S. Yang and **Zheng Gai**, *Physics* 29, 649 (2000) (invited review paper, in Chinese).
31. "STM investigation of the atomic structures and dynamic processes of germanium and silicon surfaces", **Zheng Gai**, W.S. Yang, *J. Chinese Electron Microscopy Society* 19, 104 (2000) (invited review paper, in Chinese).
32. "Atomic structure of the Si(112)7×1-In surface", **Zheng Gai**, W.S. Yang, T. Sakurai, and R.G. Zhao, *Phys. Rev. B* 61, 9928 (2000).
33. "Scanning tunneling microscopy investigation of the Si(103)1×1-In surface", **Zheng Gai**, W.S. Yang, Q.-K. Xue, T. Sakurai, and R.G. Zhao, *Surf. Rev. Lett.* 6, 405 (1999).
34. "Macroscopic and nanoscale faceting of germanium surfaces", **Zheng Gai**, W.S. Yang, R.G. Zhao, and T. Sakurai, *Phys. Rev. B* 59, 15230 (1999).
35. "Heteroepitaxy of germanium on Si(103) and stable surfaces of germanium", **Zheng Gai**, W.S. Yang, T. Sakurai, and R.G. Zhao, *Phys. Rev. B* 59, 13009 (1999).
36. "Thermal stability and structure of the equilibrium clean Si(103) surface", **Zheng Gai**, W.S. Yang, R.G. Zhao, and T. Sakurai, *Phys. Rev. B* 59, 13003 (1999).
37. "Adsorption of glycine on Cu(001) and related step faceting and bunching", Xueying Zhao, **Zheng Gai**, R.G. Zhao, W.S. Yang, and T. Sakurai, *Surf. Sci. Lett.* 424, L347 (1999).
38. "Design and test of the nanostructure-reaccessible UHVSTM system", Sheng Fang, Zhaohui Zhang, **Zheng Gai**, R.G. Zhao, and W.S. Yang, *J. Chinese Electron Microscopy Society* 18, 151 (1999) .
39. "Adsorption structures of glycine on Cu(001)", Xueying Zhao, **Zheng Gai**, R.G. Zhao, and W.S. Yang, *Acta Physica Sinica* 48, 94 (1999).
40. "Faceting and nanoscale faceting of Ge(*hhl*) surfaces around (113)", **Zheng Gai**, R.G. Zhao, Xiaowei Li, and W.S. Yang, *Phys. Rev. B* 58, 4572 (1998).

41. "Atomic structure of the Ge(313) surface", **Zheng Gai**, R.G. Zhao, and W.S. Yang, Phys. Rev. B 58, R4223 (1998).
42. "Room temperature manipulation of individual glycine molecules adsorbed on the Cu(111) surface", Xueying Zhao, R.G. Zhao, **Zheng Gai**, and W.S. Yang, Acta Physica Sinica 47, 1304 (1998).
43. "Spontaneous breaking of nanowires between a STM tip and the Pb(110) surface", **Zheng Gai**, Xiaowei Li, Bo Gao, R.G. Zhao, W.S. Yang, and J.W.M. Frenken, Phys. Rev. B 58, 2185 (1998).
44. "Atomic structure of the Ge(15 3 23) surface", **Zheng Gai**, Xiaowei Li, R.G. Zhao, and W.S. Yang, Phys. Rev. B 57, R15060 (1998).
45. "Atomic structure of the Ge(001)7×5.5-Ga surface", **Zheng Gai**, R.G. Zhao, Hang Ji, and W.S. Yang, Surf. Sci. Lett. 405, L484 (1998).
46. "Atomic structure of the domain walls of the discommensurate phases in Ge(111)/Ga", **Zheng Gai**, Bo Gao, Hang Ji, R.G. Zhao, and W.S. Yang, Surf. Rev. Lett. 5, 175 (1998).
47. "Surfaces and interfaces of the group-IV semiconductors", **Zheng Gai**, R.G. Zhao, Hang Ji, and W.S. Yang, Acta Scientiarum Naturalium Universitatis Pekinensis. 34, 159 (1998) (invited review paper).
48. "Atomic structure of the Ge(101) surface", **Zheng Gai**, R.G. Zhao, and W.S. Yang, Phys. Rev. B 57, R6795 (1998).
49. "Applications of STM in nanotechnology", **Zheng Gai**, Hongbin Yu, Yi He, and W.S. Yang, J. Chinese Electron Microscopy Society 16, 693 (1997).
50. "Atomic structure of high-index Ge surfaces consisting of periodic nanoscale facets", **Zheng Gai**, R.G. Zhao, Hang Ji, Xiaowei Li, and W.S. Yang, Phys. Rev. B 56, 12308 (1997).
51. "Migration of subsurface self-interstitial atoms of the Ge(113) surface and the energy barrier", **Zheng Gai**, R.G. Zhao, and W.S. Yang, Phys. Rev. B 56, 12303 (1997).
52. "A comparative study of the thermal stability of the (103) surface of group-III- metal/group-IV-semiconductor systems", Hang Ji, Xiaowei Li, R.G. Zhao, **Zheng Gai**, and W.S. Yang, Surf. Sci. 384, 276 (1997).
53. "Surface reconstructions and faceting of the Ga/Ge(113) system", **Zheng Gai**, R.G. Zhao, Bo Gao, Hang Ji, and W.S. Yang, Surf. Sci. 383, 1 (1997).
54. "Observation of conductance quantization of metallic ballistic point contacts at room temperature", W.S. Yang, **Zheng Gai**, Yi He, and Hongbin Yu, in *Looking to the 21st century* (World scientific, Singapore, 1997), p 987.
55. "Local work function measured with scanning tunneling microscopy", J.F. Jia, **Zhang Gai**, W.S. Yang, K. Inoue, Y. Hasegawa, T. Sakurai, Acta Physica Sinica 46, 1552 (1997).

56. "Spontaneous thinning of necks between STM tip and the Pb(110) surface", Bo Gao, **Zheng Gai**, W.S. Yang, and J.W.M. Frenken, *Acta Physica Sinica* 46, 688 (1997).
57. "Observation of bias-voltage-induced atomic diffusion on a gold STM tip", Hongbin Yu, Bo Gao, **Zheng Gai**, and W.S. Yang, *Acta Physica Sinica* 46, 679 (1997).
58. "Manipulation of gold single crystal islands on HOPG surface with a STM tip", Hongbin Yu, Bo Gao, **Zheng Gai**, and W.S. Yang, *Acta Physica Sinica* 46, 505 (1997).
59. "Challenges and potentials brought to surface science by STM", W.S. Yang and **Zheng Gai**, *Physics* 25, 513 (1996).
60. "Surface structure of the (3×1) and (3×2) reconstruction of Ge(113)", **Zheng Gai**, Hang Ji, Bo Gao, R.G. Zhao, and W.S. Yang, *Phys. Rev. B.* 54, 8593 (1996).
61. "Application of moiré fringes in investigations of subsurface imperfections", **Zheng Gai**, Yi He, Xiaowei Li, J.F. Jia, and W.S. Yang, *Surf. Sci.* 365, 96 (1996).
62. "Concerted motion of Ge adatoms on the moderate temperature phase of the Ge(111) surface", **Zheng Gai**, Yi He, and W.S. Yang, *Acta Physica Sinica* 45, 108 (1996).
63. "Adatom diffusion on Ge(111) and the corresponding activation energy barrier", **Zheng Gai**, Hongbin Yu, and W.S. Yang, *Phys. Rev. B* 53, 13547 (1996).
64. "Scanning tunneling microscopy investigation of the conductance quantization of room temperature ballistic metallic point contacts", **Zheng Gai**, Yi He, Hongbin Yu, and W.S. Yang, *Physics* 25, 166 (1996).
65. "Scanning Tunneling Microscopy Investigation of the Aggregation Phases of Amphiphile Molecules", **Zheng Gai**, W.S. Yang, and Weijing Zhou, *Acta Physico-Chimica Sinica* 12(4), 302 (1996).
66. "Chemisorption of group-III metals on the (111) surface of group-IV semiconductors: In/Ge(111)", **Zheng Gai**, R.G. Zhao, Yi He, Hang Ji, Chuan Hu, and W.S. Yang, *Phys. Rev. B* 53, 1539 (1996).
67. "Room temperature measurement of conductance quantization in metallic ballistic quantum point contacts", **Zheng Gai**, Yi He, Hongbin Yu, and W.S. Yang, *Phys. Rev. B* 53, 1042 (1996).
68. "{310} faceting of the Ge(001)2×1 surface induced by indium", **Zheng Gai**, Hang Ji, Yi He, Chuan Hu, R.G. Zhao, and W.S. Yang, *Surf. Sci. Lett.* 338, L851 (1995).
69. "Scanning tunneling microscopy investigation of bainite in steel", Junjue Yan, Hongbin Yu, **Zheng Gai**, Yun Huang, Hongsheng Fang, Jiajun Wang, Zhigang Yang, and Xurui Deng, *J. Vac. Sci. Technol. B* 12, 1793 (1994).