

# *Curriculum Vitae*

## **LUNING ZHANG**

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### **EDUCATION & PROFESSIONAL TRAINING**

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- Postdoctoral Researcher, Molecular Physics Laboratory, SRI International, Menlo Park, CA July, 2008-Sept., 2010. Research Program Adviser: Jochen Marschall
- Ph.D., Physical Chemistry. Department of Chemistry, University of California, Berkeley. Completed: June 30, 2008. Degree Conferred: Dec. 20, 2008. Thesis committee: Y. Ron Shen (adviser), Gabor A. Somorjai, Ronald C. Cohen, Feng Wang. Thesis: **Nonlinear Vibrational Spectroscopic Studies of Molecular Interaction and Charging Behavior at Solid/Liquid Interfaces.**
- M.Sc., Physical and Environmental Chemistry. Department of Chemistry, Fudan University, Shanghai, China. Completed: July, 2001. Thesis: **Matrix Isolation IR Spectroscopic studies of Main Group Element Carbonyls.**
- B.S., Chemistry. Department of Chemistry, Fudan University, China. 1998

### **RESEARCH EXPERIENCES**

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#### **2010-2011 (Innovator at Siemens)**

**Highlights: Perform detailed analysis and evaluation of most recent scientific and technological development in the area of materials, sensors, analytical equipments, and medical devices. Delivered two research proposals, presented more than 10 research pipelines, and managed two research projects.**

- Identified and successfully developed high temperature ceramic materials with extreme thermal shock resistance (over 200 times at 1350 Celsius) and oxidation resistance.

#### **2008-2010 (Postdoctoral)**

**Highlights: Initiated research on the study of surface nitridation of graphite materials, and the thermal properties of ultra-high temperature ceramics.**

- Clarified previous controversy of reaction rate between atomic nitrogen and graphite.
- Initiated studies on surface modification of pyrolytic graphite and graphene materials using nitrogen atom. Observed directional etching and unique nanostructures on the surface.
- Built high-sensitivity photothermal radiometry equipment for measuring thermal diffusivity of metal diboride materials. Studied the composition effects on the electronic and lattice contributions of thermal conductivities.

#### **2002-2008 (Ph.D.)**

**Highlights: Led a series of studies of solid-liquid interfaces, including molecular adsorption, surface charging behavior, and water on superhydrophobic surface. First use of phase-sensitive Sum-Frequency Vibrational Spectroscopy (SFVS) to obtain absolute molecular orientation at solid-liquid interface.**

- Initiated the study of point of zero charge of oxide surfaces using SFVS. Proved the unique relation between charging behavior and water hydrogen bonding at the interface.
- Confirmed adsorption mechanisms of model waste chemicals on both hydrophobic and hydrophilic substrates related to water purification.
- Established for the first time the correlation between surface structure, surface roughening, and hydroxylation reactions of aluminum oxide using Attenuated Total-Reflection Fourier Transform Infrared, SFVS and Atomic Force Microscopy.
- Studied hydrophobic to hydrophilic transitions at water/nanostructured silica film interfaces. Established spectroscopic evidence of Cassie-Baxter to Wenzel state transition.

### **1998-2001 (Master)**

- Improved matrix isolation technique by combining FTIR with pulsed laser ablation to the study of reaction intermediates of hot metal atoms and electrons with various gas species.
- Identified the reaction pathways and reaction intermediates of a series of transition metals (Sc, Ti, V, Cr, Mn, Fe, Nb, Ta, Y, La) with water molecules using matrix isolation technique.
- Reported for the first time neutral and ionic reaction products between silicon, aluminum, and arsenic with carbon monoxide.
- Studied the mechanism of several important atmospheric reactions using quantum calculation.

### **Laboratory Skills:**

- Operation and maintenance of pulsed laser systems (Nd:YAG laser, Q-switch, mode-locking), and optical parametric generator/amplifier (OPG/OPA) systems. Experienced in nonlinear optical spectroscopy, photon detection, cryostat (4-77K), vacuum systems, atomic force microscope, temperature sensing and control, and computer data acquisition.
- Familiar with sputtering, atomic layer deposition (ALD) of thin film, and pulsed laser ablation/deposition (PLA/PLD) processes.
- Master-level user of specialized programs: Gaussian, Origin, Mathematica, MathCad. Familiar with LabView, MaterialStudio, C++.
- Familiar with safety regulations such as: Laser Hazard Analysis (ANSI Z-136.1, 2000), Chemical Hygiene Plan (CHP-OSHA), Injury and Illness Prevention Program (IIPP), etc.

### **Team Experience:**

- Lab Safety Warden for 5 years for a research group consisted of six labs and more than ten people. Trained group members regarding safety regulations. Coordinated and guided laser & chemical safety inspections with campus and LBNL EH&S, and CalOSHA officers.
- Teamwork experience with 12 researchers from UIUC, Sandia National Laboratories, Lawrence Berkeley National Laboratory, University of Vermont, and Missouri Univ. of Science and Technology.

## **PROFESSIONAL ACTIVITIES**

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### **Formal Presentations**

- 2003 APS March meeting, Austin, TX.  
Title: Adsorption of Ammonia on Ice Surface.
- 2005 APS March meeting, Los Angeles, CA.  
Title: Structure of the Alcohol/Silica Interfaces.

- 2005 WaterCAMPWS NSF Center, Review Meeting, Atlanta, GA.  
 Title: Competitive Molecular Adsorption at Liquid/Solid Interfaces.
- 2006 MRS Spring meeting, San Francisco, CA.  
 Title: Competitive Molecular Adsorption at Liquid/Solid Interfaces studied by SFVS.
- 2007 ACS Spring Meeting, Chicago, IL.  
 Title: Water Interaction with Nanostructured Silicon Oxide Surfaces.
- 2008 ACS Spring Meeting, New Orleans, LA.  
 Title:  $\alpha$ -Alumina (0001)/water Interface: Structures and Charges.
- 2009 AIAA Meeting, San Antonio, TX  
 Title: Laboratory investigation of active graphite nitridation by atomic nitrogen.

### **Teaching Experience**

- Department of Chemistry, University of California, Berkeley, CA 2001, 2003, 2005
- Graduate student instructor in Chemistry 1A and 1B classes.  
 Taught laboratory sessions and led discussion/review sessions for three semesters.
- Department of Physics, University of California, Berkeley, CA 2003
- Reader for Quantum Mechanics Course for graduate students.
- Department of Chemistry, Fudan University, Shanghai, PRC 2000
- Reader for Physical Chemistry Course for undergraduate students.

### **Awards and Honors**

- 2007, Award for Achievement in Scientific Research (sharing with 4 other researchers), Government of Shanghai, Shanghai, P. R. China.
- 2004, 2<sup>nd</sup> Award for Natural Science Research (sharing with 4 other researchers), Chinese National Science Foundation (CNSF), P. R. China.
- 2004, Outstanding Thesis of Master Student, Department of Education, P. R. China.
- 2000, 1<sup>st</sup> place Fellowship for graduate students, Dong's Oriental Award, Fudan University.

### **Research Publications**

#### **Publication List from 1999 to 2011**

- (1) **Laboratory investigation of active graphite nitridation by atomic nitrogen.**  
 L. Zhang, D. A. Pejakovic, J. Marschall, D. Fletcher, *J. Thermophys. Heat Transfer*, 2011 (in press).
- (2) **Effect of Composition on the Thermal and electrical resistivity properties of HfB<sub>2</sub> based materials.**  
 L. Zhang, D. A. Pejakovic, J. Marschall, M. Gausch, *J. Am. Ceram. Soc.* 2011 (in press). (IF: 1.944)
- (3) **Effect of pH on the water/ $\alpha$ -sapphire (1-102) interface structure studied by Sum-Frequency Vibrational Spectroscopy.**  
 J. Sung, L. Zhang, C. S. Tian, G. A. Waychunas, Y. R. Shen, *J. Am. Chem. Soc.* 2011 (under review) (IF: 8.580)
- (4) **Surface Modification of Highly Oriented Pyrolytic Graphite by Reaction with Atomic Nitrogen at High Temperatures.**  
 L. Zhang, D. A. Pejakovic, B. Geng, J. Marschall, *Applied Surface Science*, 2011, 257, 5647-5656. (IF: 1.616)
- (5) **Surface Structure of Protonated R-Sapphire (1-102) Studied by Sum-Frequency Vibrational Spectroscopy.**  
 J. Sung, L. Zhang, C. S. Tian, G. A. Waychunas, Y. R. Shen, *J. Am. Chem. Soc.* 2011, 133(1), 3846-3853. (IF: 8.580)
- (6) **Nanoporous silica/Water Interfaces studied by Sum-Frequency Vibrational Spectroscopy. (8)**  
 L. Zhang, C. S. Tian, Y. Wu, S. Singh, C. J. Brinker, M. A. Shannon, Y. R. Shen, *J. Chem. Phys.* 2009, 130, 154702. (IF: 3.093)
- (7) **High-Temperature Hydroxylation of Alumina Crystalline Surfaces. (4)**  
 R. Chandrasekharan, L. Zhang, V. Ostroverkhov, S. Prakash, Y. Wu, Y. R. Shen, M. A. Shannon, *Surface Science*, 2008, 602, 1466. (IF: 1.798)
- (8) **Structures and charging of  $\alpha$ -Alumina(0001)/water Interfaces studied by Sum-Frequency Vibrational Spectroscopy. (22)**  
 L. Zhang, C. S. Tian, G. A. Waychunas, Y. R. Shen, *J. Am. Chem. Soc.* 2008, 130, 7686. (IF: 8.580)
- (9) **Competitive Molecular Adsorption at Liquid/Solid interfaces: A study by Sum-Frequency Vibrational Spectroscopy. (4)**  
 L. Zhang, W. T. Liu, Y. R. Shen, D. G. Cahill, *J. Phys. Chem. C* 2007, 111(5), 2069. (IF: 4.224)
- (10) **Interfacial Structures of Methanol:Water mixtures at a Hydrophobic Interface probed by Sum-Frequency Vibrational Spectroscopy. (9)**  
 W. T. Liu, L. Zhang, Y. R. Shen, *J. Chem. Phys.* 2006, 125(14), 144711. (IF: 3.093)
- (11) **Interfacial layer structure at Alcohol/Silica Interfaces probed by Sum-Frequency Vibrational Spectroscopy. (6)**  
 W. T. Liu, L. Zhang, Y. R. Shen, *Chem. Phys. Lett.* 2005, 412, 206. (IF: 2.291)

- (12) **Reactions of zirconium and hafnium atoms with ammonia. Matrix infrared spectra and density functional calculations of the MNH<sub>3</sub> and H<sub>2</sub>MNH (M = Zr and Hf) molecules.**  
M. F. Zhou, M. H. Chen, L. Zhang, *J. Phys. Chem. A* 2002, 106 (39), 9017-9023. (IF: 2.899)
- (13) **Reaction of silicon dioxide with water: a matrix isolation infrared and density functional theoretical study.**  
M. F. Zhou, L. Zhang, H. Lu, L. Shao, M. H. Chen, *J. Mol. Struct.* 2002, 605 (2-3), 249-254. (IF: 1.551)
- (14) **Computational studies on the reaction pathways of CF<sub>3</sub>Br with O(<sup>1</sup>D, <sup>3</sup>P) atoms.**  
L. Zhang, Q. Z. Qin, *J. Phys. Chem. A* 2001, 105 (1), 215-218. (IF: 2.899)
- (15) **Formation and characterization of the (η<sup>2</sup>-H<sub>2</sub>)CrO<sub>2</sub>, (η<sup>2</sup>-H<sub>2</sub>)<sub>2</sub>CrO<sub>2</sub> and HCrO(OH) molecules.**  
M. F. Zhou, L. Zhang, L. M. Shao, et al. *J. Phys. Chem. A* 2001, 105(47), 10747-10752. (IF: 2.899)
- (16) **Chromium oxide complexes with dinitrogen. Formation and characterization of the (NN)<sub>x</sub>CrO and (NN)<sub>x</sub>CrO<sub>2</sub> (x=1,2).**  
M. F. Zhou, L. Zhang, Q. Z. Qin, *J. Phys. Chem. A* 2001, 105(26), 6407-6413. (IF: 2.899)
- (17) **Reactions of laser-ablated Y and La atoms with H<sub>2</sub>O infrared spectra and density functional calculations of the HMO, HMOH and M(OH)<sub>2</sub> molecules in solid argon.**  
L. Zhang, L. M. Shao, M. F. Zhou, *Chem. Phys.* 2001, 272(1), 27-36. (IF: 2.277)
- (18) **Reactions of titanium oxides with water molecules. A matrix isolation FTIR and density functional study.**  
L. M. Shao, L. Zhang, M. H. Chen, et al. *Chem. Phys. Lett.* 2001, 343(1-2), 178-184.
- (19) **Reactions of Fe with H<sub>2</sub>O and FeO with H<sub>2</sub>. A combined matrix isolation FTIR and theoretical study.**  
L. Zhang, M. F. Zhou, L. M. Shao, et al. *J. Phys. Chem. A* 2001, 105(29), 6998-7003.
- (20) **Reactions of Mn with H<sub>2</sub>O and MnO with H<sub>2</sub>. Matrix-isolation FTIR and quantum chemical studies.**  
M. F. Zhou, L. Zhang, L. M. Shao, et al. *J. Phys. Chem. A* 2001, 105(24), 5801-5807.
- (21) **Reactions of group V metal atoms with water molecules. Matrix isolation FTIR and quantum chemical studies.** M. F. Zhou, J. Dong, L. Zhang, et al. *J. Am. Chem. Soc.* 2001, 123(1), 135-141.
- (22) **Matrix isolation FTIR spectroscopic and density functional theoretical studies of the nickel, copper, and silver carbonyl chlorides.** L. M. Shao, L. Zhang, M. F. Zhou, et al. *Organometallics* 2001, 20(6), 1137-1143.
- (23) **Formation and characterization of the AsCO and AsCO<sup>-</sup> molecules. A matrix isolation FTIR and theoretical study.** L. Zhang, J. Dong, M. F. Zhou, *Chem. Phys. Lett.* 2001, 335(3-4), 334-338.
- (24) **The AlCO<sup>-</sup> and Al(CO)<sub>2</sub><sup>-</sup> anions: Matrix isolation infrared spectra and density functional theory studies.**  
L. Zhang, J. Dong, M. F. Zhou, et al. *J. Chem. Phys.* 2000, 113(22), 10169-10173.
- (25) **Matrix infrared spectra and quantum chemical calculations of the MCO<sup>-</sup> (M = Si, Ge, Sn) anions.**  
L. Zhang, J. Dong, M. F. Zhou, *J. Chem. Phys.* 2000, 19, 8700-8705.
- (26) **Carbon dioxide fixation by copper and silver halide. Matrix-isolation FTIR spectroscopic and DFT studies of the XMOCO (X = Cl and Br, M = Cu and Ag) molecules.**  
M. F. Zhou, L. Zhang, M. H. Chen, et al. *J. Phys. Chem. A* 2000, 104(45), 10159-10164.
- (27) **Matrix-isolation FTIR spectroscopic and DFT studies of the XMNN (X=Cl, Br, M=Cu, Ni) molecules.**  
M. H. Chen, M. F. Zhou, L. Zhang, et al. *J. Phys. Chem. A* 2000, 104(38), 8627-8631.
- (28) **Infrared spectra and theoretical studies of the C<sub>2</sub>O<sub>3</sub><sup>-</sup> anion isolated in solid argon.**  
M. F. Zhou, L. Zhang, M. H. Chen, et al. *J. Chem. Phys.* 2000, 112(16), 7089-7094.
- (29) **An experimental and ab initio study of hypervalent LiOZn.**  
Z. W. Fu, L. Zhang, Q. Z. Qin, et al. *J. Phys. Chem. A* 2000, 104(13), 2980-2984.
- (30) **Structure and stability of LiOMn molecule generated by laser ablation.**  
M. F. Zhou, Z. W. Fu, L. Zhang, Q. Z. Qin, *Chem. Phys. Lett.* 2000, 318, 644-648.
- (31) **Reactions of group IV metal atoms with water molecules. Matrix isolation FTIR and theoretical studies.**  
M. F. Zhou, L. Zhang, J. Dong, et al. *J. Am. Chem. Soc.* 2000, 122(43), 10680-10688.
- (32) **Matrix-isolation Fourier transform infrared and theoretical studies of laser-ablated Sc atom reactions with water molecules.** L. Zhang, J. Dong, M. F. Zhou, *J. Phys. Chem. A* 2000, 104(39), 8882-8886.
- (33) **IR spectroscopic and DFT studies on the reactions of laser-ablated Nb atoms with carbon dioxide.**  
M. H. Chen, X. F. Wang, L. Zhang, et al. *J. Phys. Chem. A* 2000, 104(30), 7010-7015.
- (34) **Dioxygen bound to copper and nickel halides: matrix-isolation FTIR and DFT studies on ClCu(O<sub>2</sub>) and ClNi(O<sub>2</sub>) molecules.** L. Zhang, M. F. Zhou, M. H. Chen, et al. *Chem. Phys. Lett.* 2000, 325(4), 447-452.
- (35) **Theoretical investigation on the potential energy surface for the reactions of B, Al and Ga with NO.**  
L. Zhang, Zhou, M. F. Zhou, *Chem. Phys.* 2000, 256(2), 185-194
- (36) **The CO<sub>2</sub>-NO van der Waals complex and the covalently bonded CO<sub>2</sub>NO<sup>-</sup> anion: A matrix isolation FTIR and theoretical study.** M. F. Zhou, L. Zhang, Q. Z. Qin, *J. Am. Chem. Soc.* 2000, 122(18), 4483-4488.
- (37) **Photomobility of O(<sup>1</sup>D) atom in solid Ar and its reaction with CF<sub>3</sub>I.**  
M. H. Chen, X. F. Wang, L. Zhang, et al. *Chem. Phys. Lett.* 2000, 255(1), 95-102.
- (38) **Activation of CO<sub>2</sub> by Zr atom. Matrix-isolation FTIR spectroscopy and density functional studies.**  
L. Zhang, X. F. Wang, M. H. Chen, et al. *Chem. Phys. Lett.* 2000, 254(2-3), 231-238.
- (39) **Spectroscopic and theoretical studies on the reactions of laser-ablated tantalum with carbon dioxide.**  
X. F. Wang, M. H. Chen, L. Zhang, et al. *J. Phys. Chem. A* 2000, 104(4), 758-764.
- (40) **Density functional calculations on the Zr-CO<sub>2</sub> complexes.**  
L. Zhang, X. F. Wang, Q. Z. Qin, *J. Mol. Struct.-THEOCHEM* 2000, 505, 179-183.
- (41) **Theoretical studies on CS<sub>2</sub>OH-O<sub>2</sub>: a possible intermediate in the OH initiated oxidation of CS<sub>2</sub> by O<sub>2</sub>.**  
L. Zhang, Q. Z. Qin, *J. Mol. Struct.-THEOCHEM* 2000, 531, 375-379.

- (42) **A theoretical study on the novel molecule OSiCO and its isomers.**  
L. Zhang, Q. Q. Qin, *Chem. Phys. Lett.* 2000, 326, 494-500.
- (43) **Mobility of oxygen atoms generated from photolysis of O<sub>3</sub> isolated in argon matrices.**  
X. J. Ning, L. Zhang, M. H. Chen, *J. Chem. Phys.* 2000, 112, 386-395.
- (44) **DFT calculation and matrix isolation FTIR studies on the formation of CF<sub>3</sub>OBr from O(<sup>1</sup>D) and CF<sub>3</sub>Br in solid argon.** L. Zhang, X. F. Wang, M. H. Chen, et al. *Chem. Phys.* 1999, 249(2-3), 161-168.
- (45) **Matrix-isolation infrared spectroscopic studies on ablated products generated from laser ablation of Ta<sub>2</sub>O<sub>5</sub> and Ta in ambient O<sub>2</sub>/Ar gas.**  
M. H. Chen, X. F. Wang, L. Zhang, M. H. Chen, Q. Z. Qin, *Chem. Phys.* 1999, 242(1), 81-90.

## **Professional References**

Dr. Y. Ron Shen (professor): yrshen at berkeley.edu

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Dr. Jochen Marschall (senior staff scientist): jochen.marschall at sri.com