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Education

Xiangtan University, Xiangtan, China	Chemistry	B.S., 1995
Xiangtan University, Xiangtan, China	Chemistry	M.S., 1998
University of Tennessee-Knoxville	Chemistry	Ph.D., 2005

Professional Experience

2008–p	Research Staff Member, Chemical Functionality Group, Center for Nanophase Materials Sciences, Oak Ridge National Laboratory (ORNL)
2006–2008	Staff Scientist, Chemical Sciences Division, ORNL
2005–2006	Postdoctoral Research Associate, Chemical Sciences Division, ORNL
2002–2005	Research Fellow, Tennessee Advanced Material Laboratory, ORNL/Univ. of Tennessee-Knoxville
2000–2001	Visiting Scholar, Department of Chemistry, (UTK)
1998–2000	Research Staff, Zhuzhou Institute of Technology and College of Chemistry and Chemical Engineering, Hunan University, Xiangtan, China
1995–1998	Graduate Teaching Assistant, Department of Chemistry, Xiangtan University, Xiangtan, China
1994–1997	Field Consultant, Zhejiang Huahai Pharmaceutical Co., Zhejiang, China

Professional and Synergistic Activities

2007; 2008	Lead PI, Novel High Power Cathodes for Lithium-Ion Rechargeable Batteries, ORNL Seed Money Committee
2010–p	Lead PI, Studies of Long Cycle-life Lithium-Sulfur Batteries, DOE-EERE
2009–p	Lead PI, BES
2005–p	Memberships: <i>American Chemical Society</i> , <i>Electrochemical Society</i> ,
2008–p	Reviewer, DOE SBIR-STTR and BES Proposals
	Journal Reviewer, <i>Science</i> , <i>Journal of the American Chemical Society</i> , <i>Journal of Physical Chemistry</i> , <i>Journal of Electrochemical Society</i> , <i>Industrial & Engineering Chemistry Research</i> , <i>Journal of Power Sources</i> , <i>Journal of Catalysis</i> , <i>Microporous and Mesoporous Materials</i> , <i>Chemistry-A European Journal</i> , <i>ACS Nano</i> , <i>Electrochemistry Communications</i> , <i>Electrochimica Acta</i> , <i>Chemical Communications</i> , <i>ACS Applied Materials & Interfaces</i> , <i>Physical Chemistry Chemical Physics</i> , <i>Dalton Transactions</i> , and <i>Materials Research Bulletin</i>

Honors and Awards

2011	Certification of Appreciation, reviewer for the American Society of Chemistry (ACS)
2010	Winner of R&D 100 Award, Project Leader for Development Research in Lithium-Sulfur Batteries
2010	Energy Storage Program Manager's Recognition Award
2010	ORNL Significant Event Award, New Programs and Awards in Advanced Battery Chemistry
2007	Project Management Certificate Award
2002–2005	Tennessee Advance Materials Laboratory Fellowship (TAML), ORNL/UTK Distinguished Scientist Program

Patents

- “Robust Carbon Monolith Having Hierarchical Porosity,” S. Dai, G. Guiochon, and C. D. Liang, U.S. Patent No. 7,892,516 B2, Feb. 22, 2011.
- “Highly Ordered Porous Carbon Materials Having well Defined Nanostructures and Method of Synthesis,” S. Dai and C. D. Liang, U.S. Patent Applic. No. 2006/0057051 A1, Mar. 16, 2006.
- “Synthesis and Applications of Ordered Mesoporous Carbon,” S. Dai and C. D. Liang, U.S. Patent Applic. No. 2006/0057051, Sept. 28, 2004.
- “Sulfur-Carbon Composites and Their Application as Cathode Materials in Lithium-Sulfur Batteries,” C. D. Liang, N. Dudney, and J. Howe, U.S. Provisional Patent Applic. No. 61/239,132.
- “Lipon Coating for High Voltage and High Temperature Li-ion Battery Cathodes,” N. Dudney, C. Liang, N. Jagjit, V. Gabriel, Y. Kim, U.S. Provisional Patent.

“Lithium Sulfide Compositions for Battery Electrolyte and Electrode Coatings,” C.D. Liang, Z.C. Liu, W.J. Fu, Z. Lin, N. Dudney, J. Howe, and A.J. Rondinone, U.S. Patent Application NO. 13/463451; filed on May/3, 2012

Recent Invited Talks and Contributed Conference Presentations:

- “All-solid Lithium-Sulfur Batteries,” 6th US-China Electric Vehicle and Battery Technology Workshop, University of Massachusetts Boston, Boston, MA, August 24-25, 2012.
- “Challenges and Solutions for Lithium-Sulfur Batteries,” 4th US-China Electric Vehicle and Battery Technology Workshop, Argonne National Laboratory, Argonne, IL, August 4-5, 2011.
- “Advanced Materials for Li-S Batteries,” 4th Symposium on Energy Storage: Beyond Lithium Ion, Pacific Northwest National Laboratory, Richland, WA, June 7-9, 2011.
- “Carbon Nanostructures for Energy Applications,” Oak Ridge Institution of Continued Learning, Oak Ridge, TN, March 9, 2011.
- “Multiscale Porous Carbon Materials for Energy Storage,” CNMS User Meeting, Center for Nanophase Materials Sciences, Oak Ridge National Laboratory, Oak Ridge, TN, September 13, 2010.
- “Multiscale Porous Carbons for Energy Applications,” East China University of Science and Technology, Shanghai, China, August 10-13, 2010.
- “Research Opportunities and Capabilities at the Center for Nanophase Materials Sciences,” Xiangtan University, Xiangtan, Hunan, China, July 26-30, 2010.
- “Multiscale Porous Carbons for Energy Applications Liox,” California Institute of Technology (Caltech), Pasadena, CA, March 18, 2010.

Publications: (total > 59 refereed journal papers and conference proceedings, 4 book chapters, > 2500 citations)

Research Synopsis: Research focuses on the fundamental understanding of the catalytic behavior of nanomaterials through designed interfaces, controlled morphologies and particle sizes, and tailored functionalities. The materials of interest include high-surface area porous materials, alloy nanoparticles, carbon catalysts, carbides, and hydrothermally grown crystals. Synthesis expertise includes four directions: (1) template-assisted synthesis of mesoporous materials including soft-template and hard-template synthesis of ordered mesoporous carbons and oxides; (2) metal and metal oxide nanoparticles through surfactant-mediated, solvothermal, and template-assisted synthesis methods; (3) nanocatalysts supported on porous materials by co-synthesis and incipient wetting synthesis; and (4) chemical.

Collaborations from other Institutions (past 48 months): C. Barnes (Univ. of Tennessee-Knoxville); B. L. Chen (Univ. of Texas-Pan American); N. S. Chong (Middle Tennessee State University); V. V. Guliyants (Univ. of Cincinnati); N. Holzwarth (Wake Forest Univ.); M. Jaroniec (Kent State University); Y. S. Yan (Univ. of California-Riverside)

Graduate and Postdoctoral Advisors and Advisees:

Ph.D. Advisor: G. Guiochon, Univ. of Tennessee-Knoxville/ORNL
Postdoctoral Advisor: S. Dai, Oak Ridge National Laboratory

Graduate and Postdoctoral Advisees:

Postdoctoral Advisees: Wujun Fu (Oak Ridge National Laboratory); Zhan Lin (Oak Ridge National Laboratory); Zengcai Liu (Oak Ridge National Laboratory)

PUBLICATIONS

Chengdu Liang

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Book Chapters:

- Z. Liu, W. Fu, C. Liang, "Lithium Sulfur Batteries," Chapter 24 in "*Handbook of Battery Materials*," 2nd Edition, Vol. 1, eds., C. Daniel and J. O. Besenhard, Wiley-VCH, Hoboken, NJ (2011).
- X. Wang, C. Liang, S. Dai, "Nano/Microporous Materials: Mesoporous and Surface-Functionalized Mesoporous Carbon," in "*Nanomaterials: Inorganic and Bioinorganic Perspectives*," eds., C. M. Lukehart and R. A. Scott, Wiley-VCH, Hoboken, NJ (2009).
- X. Wang, C. Liang, S. Dai, "Nano/Microporous Materials: Mesoporous and Surface-Functionalized Mesoporous Carbon," in "*Encyclopedia of Inorganic Chemistry*," 2nd Edition, ed., R. Bruce King, Wiley-VCH, Hoboken, NJ (2009).
- H. Kim, C. Liang, and S. Dai, "Hierarchically Imprinted Adsorbents," Chapter 9 in "*Environmental Applications of Nanomaterials: Synthesis, Sorbents and Sensors*," eds., G. E. Fryxell and G. Cao, World Scientific Publishing, Co., Hackensack, NJ (2007).
- S. Dai, Z. Zhang, and C. Liang, "Hierarchically Imprinted Nanostructures for Separation of Metal Ions," pp. 1369-1376 in "*Dekker Encyclopedia of Nanoscience and Nanotechnology*," eds., J. A. Schwartz, C. I. Contescu, and K. Putyera, Marcel Dekker, Inc., New York City, NY (2004).

Selected Peer-Reviewed Publications:

- Z. Lin, Z. Liu, W. Fu, N. Dudney, and CD Liang; "Phosphorous Pentasulfide as a Novel Additive for High-Performance Lithium-Sulfur Batteries," *Advanced Functional Materials*, 2012. <http://dx.doi.org/10.1002/adfm.201200696>
- Lu Cai, Zengcai Liu, Ke An, and Chengdu Liang; "Probing Li-Ni Cation Disorder in Li_{1-x}Ni_{1+x-y}Al_yO₂ Cathode Materials by Neutron Diffraction", *Journal of The Electrochemical Society*, **159** (7) A1-A5 (2012)
- J. Y. Howe, L. A. Boatner, J. A. Kolopus, L.R. Walker, C. Liang, N. J. Dudney, and C. R. Schaich, "Vacuum-tight sample transfer stage for a scanning electron microscopic study of stabilized lithium metal particles," *Journal of Materials Sciences* **47**, 1572 (2012).
- W. Fu, J. Kiggans, S. H. Overbury, V. Schwartz, C. Liang, Low-Temperature Exfoliation of Multilayer-Graphene Material from FeCl₃ and CH₃NO₂ Co-intercalated Graphite Compound," *Chemical Communications* **47**, 5265 (2011).
- Z. Liu, H. Zhen, Y. Kim, and C. Liang, "Synthesis of LiNiO₂ Cathode Materials with Homogeneous Al Doping at the Atomic Level," *Journal of Power Sources* **196**, 10201 (2011).
- V. Schwartz, H. Xie, H. M. Meyer, S. Overbury, C. Liang, "Oxidative Dehydrogenation of Isobutane on Phosphorous-Modified Graphitic Mesoporous Carbon," *Carbon* **49**, 659 (2011).
- T. J. Toops, N. A. Ottinger, C. Liang, J. A. Pihl, E. A. Payzant, "Impact of Dopants on the Sulfation, Desulfation and NO_x Reduction Performance of Ba-based NO_x Storage Reduction Catalysts," *Catalysis Today* **160**, 131 (2011).
- X. Q. Wang, Q. Zhu, S. M. Mahurin, C. D. Liang, S. Dai, "Preparation of Free-standing High Quality Mesoporous Carbon Membranes," *Carbon* **48**, 557 (2010).
- M. Xue, Z. J. Zhang, S. C. Xiang, J. Zhao, C. D. Liang, G. S. Zhu, S. L. Qiu, B. L. Chen, "Selective Gas Adsorption within a Five-Connected Porous Metal-Organic Framework," *Journal of Materials Chemistry* **20**(19), 3984 (2010).
- C. D. Liang, J. Howe, N. Dudney, "Hierarchically Structured Sulfur/Carbon Nanocomposites Material for High Energy Lithium Battery," *Chemistry of Materials* **21**, 4724 (2009).
- C. D. Liang and S. Dai "Dual Phase Separation for the Synthesis of Bimodal Meso-Macroporous Carbon Monoliths," *Chemistry of Materials* **21**, 2115 (2009).
- C. D. Liang,* H. Xie, V. Schwartz, J. Howe, and S. Overbury "Fullerene-like Graphitic Carbons as Catalysts for Oxidative Dehydrogenation of Isobutane," *Journal of the American Chemical Society* **131**, 7735 (2009).
- P. F. Fulvio, C. D. Liang, S. Dai, M. Jaroniec, "Mesoporous Carbon Materials with Ultra-Thin Pore Walls and Highly Dispersed Nickel Nanoparticles," *European Journal of Inorganic Chemistry* **5**, 605 (2009).
- H. Xie, Z. L. Wu, S. Overbury, C. D. Liang, V. Schwartz, Investigation of the Selective Sites on Graphitic Carbons for Oxidative Dehydrogenation of Isobutene, "*Journal of Catalysis* **267**, 158 (2009).

- B. L. Chen, Y. Y. Ji, M. Xue, F. R. Fronczek, E. J. Hurtado, J. U. Mondal, C. D. Liang, S. Dai, "Metal-Organic Framework with Rationally Tuned Micropores for Selective Adsorption of Water Over Methanol," *Inorganic Chemistry* **47**, 5543 (2008).
- D. R. Cole, E. Mamontov, S. Dai, M. D. Pawel, C. D. Liang, T. Jenkins, G. Gasparovic, E. J. Kintzel, L. Vitek, P. T. Cummings, "Dynamics of Water in Aqueous Solutions Confined in Silica Matrices Determined from Neutron Scattering," *Geochimica et Cosmochimica Acta* **72**, A172 (2008).
- P. F. Fulvio, M. Jaroniec, C. D. Liang, S. Dai, "Polypymole-Based Nitrogen-Doped Carbon Replicas of SBA-15 and SBA-16 Containing Magnetic Nanoparticles," *Journal of Physical Chemistry C* **112**, 13126 (2008).
- C. H. Hou, X. Q. Wang, C. D. Liang, S. Yiacoumi, C. Tsouris, S. Dai, "Molecular-Sieving Capabilities of Mesoporous Carbon Membranes," *Journal of Physical Chemistry B* **112**, 8563 (2008).
- J. F. Huang, H. M. Luo, C. D. Liang, D. E. Jiang, S. Dai, "Advanced Liquid Membranes Based on Novel Ionic Liquids for Selective Separation of Olefin/paraffin via Olefin-Facilitated Transport," *Industrial and Engineering Chemistry Research* **47**, 881 (2008).
- B. Jang, M. Helleeson, C. Shi, A. Rondinone, V. Schwartz, C. D. Liang, S. Overbury, "Characterization of Al₂O₃ Supported Nickel Catalysts Derived from RF Non-thermal Plasma Technology," *Topics in Catalysis* **49**, 145–152 (2008).
- C. D. Liang, Z. Li, S. Dai, "Mesoporous Carbon Materials: Synthesis and Modification," *Angewandte Chemie International Edition* **47**, 3696 (2008).
- E. Mamontov, D. R. Cole, S. Dai, M. D. Pawel, C. D. Liang, T. Jenkins, G. Gasparovic, E. Kintzel "Dynamics of Water in LiCl and CaCl₂ Aqueous Solutions Confined in Silica Matrices: A Backscattering Neutron Spectroscopy Study," *Chemical Physics* **352**, 117 (2008).
- P. V. Shanahan, L. B. Xu, C. D. Liang, M. Waje, S. Dai, and Y. S. Yan, "Graphitic Mesoporous Carbon as a Durable Fuel Cell Catalyst Support," *Journal of Power Sources* **185**, 423 (2008).
- N. R. Shiju, X. H. Liang, A. W. Weimer, C. D. Liang, S. Dai, V. V. Guliyants "The Role of Surface Basal Planes of Layered Mixed Metal Oxides in Selective Transformation of Lower Alkanes: Propane Ammoxidation over Surface *ab* Planes of Mo-V-Te-Nb-O M1 Phase," *Journal of the American Chemical Society* **130**, 5850 (2008).
- X. Q. Wang, C. D. Liang, S. Dai "Facile Synthesis of Ordered Mesoporous Carbons with High Thermal Stability by Self-Assembly of Resorcinol-formaldehyde and Block Copolymers under Highly Acidic Conditions," *Langmuir* **24**, 7500 (2008).
- B. L. Chen, S. Q. Ma, E. J. Hurtado, E. B. Lobkovsky, C. D. Liang, H. G. Zhu, S. Dai, "Selective Gas Sorption Within a Dynamic Metal-Organic Framework," *Inorganic Chemistry* **46**, 8705 (2007).
- K. P. Gierszal, M. Jaroniec, C. D. Liang, S. Dai, "Electron Microscopy and Nitrogen Adsorption Studies of Film-Type Carbon Replicas with Large Pore Volume Synthesized by using Colloidal Silica and SBA-15 as Templates," *Carbon* **45**, 2171 (2007).
- Z. Ma, C. D. Liang, S. H. Overbury, S. Dai, "Gold Nanoparticles on Electroless-Deposition-Derived MnOx/C: Synthesis, Characterization, and Catalytic CO Oxidation," *Journal of Catalysis* **252**, 119 (2007).
- M. Steinhart, C. D. Liang, G. W. Lynn, U. Gosele, S. Dai, "Direct Synthesis of Mesoporous Carbon Microwires and Nanowires," *Chemistry of Materials* **19**, 2383 (2007).
- B. L. Chen, C. D. Liang, J. Yang, D. S. Contreras, Y. L. Clancy, E. B. Lobkovsky, O. M. Yaghi, S. Dai, "A Microporous Metal-Organic Framework for Gas-Chromatographic Separation of Alkanes," *Angewandte Chemie International Edition* **45**, 1390 (2006).
- C. H. Hou, C. D. Zhang, S. Yiacoumi, S. Dai, C. Tsouris, "Electrosorption Capacitance of Nanostructured Carbon-Based Materials," *Journal of Colloid and Interface Science* **302**(1), 54 (2006).
- C. D. Liang and S. Dai, "Synthesis of Mesoporous Carbon Materials via Enhanced Hydrogen-Bonding Interaction," *Journal of the American Chemical Society* **128**, 5316 (2006).
- C. D. Liang, J. F. Huang, Z. J. Li, H. M. Luo, S. Dai, "A Diazonium Salt-Based Ionic Liquid for Solvent-Free Modification of Carbon," *European Journal of Organic Chemistry* **3**, 586 (2006).
- S. Mahurin, L. L. Bao, W. F. Yan, C. D. Liang, S. Dai, "Atomic Layer Deposition of TiO₂ on Mesoporous Silica," *Journal of Non-Crystalline Solids* **352**, 3280 (2006).
- H. G. Zhu, C. D. Liang, W. F. Yan, S. H. Overbury, and S. Dai, "Preparation of Highly Active Silica-Supported Au Catalysts for CO Oxidation by a Solution-Based Technique," *Journal of Physical Chemistry B* **110**, 10842 (2006).
- J. F. Huang, H. M. Luo, C. D. Liang, I. W. Sun, G. A. Baker, S. Dai, "Hydrophobic Bronsted Acid-Base Ionic Liquids Based on PAMAN Dendrimers with High Proton Conductivity and Blue Photoluminescence," *Journal of the American Chemical Society* **127**(37), 12784 (2005).
- H. G. Zhu, Z. W. Pan, E. W. Hagaman, C. D. Liang, S. H. Overbury, S. Dai, "Facile One-Pot Synthesis of Gold Nanoparticles Stabilized with Bifunctional Amino/Siloxy Ligands," *Journal of Colloid and Interface Science* **287**, 360 (2005).
- C. D. Liang, K. L. Hong, J. Mays, G. Guiochon, S. Dai, "Synthesis of Large-scale Highly Ordered Porous Carbon Film via Self-assembly of Block Copolymers," *Angewandte Chemie International Edition* **43**, 5785 (2004).

- Z. J. Li, G. D. Del Cul, W. F. Yan, C. D. Liang, S. Dai, "Fluorinated Carbon with Ordered Mesoporous Structure," *Journal of the American Chemical Society* **126**(40), 12782 (2004).
- L. L. Bao, M. S. Mahurin, C. D. Liang, S. Dai, "Study of Silver Films over Silica Beads as a Surface Enhanced Raman Scattering (SERS) Substrate for Detection of Benzoic Acid," *Journal of Raman Spectroscopy* **34**, 394 (2003).
- C. D. Liang, S. Dai, G. Guiochon, "A Graphitized-Carbon Monolithic Column," *Analytical Chemistry* **75**(18), 4904 (2003).
- C. D. Liang, S. Dai, G. Guiochon, "Use of Gel-Casting to Prepare HPLC Monolithic Silica Columns with Uniform Mesopores and Tunable Macrochannels," *Chemical Communications* **22**, 2680 (2002).
- C. D. Liang, M. J. Weaver, S. Dai, "Change of pH Indicator's pK(a) Value via Molecular Imprinting Chemical Communications **15**, 1620 (2002).
- C. D. Liang, C. Y. Yuan, R. J. Warmack, C. E. Barnes, S. Dai, "Ionic liquids: A New Class of Sensing Materials for Detection of Organic Vapors Based on the Use of a Quartz Crystal Microbalance," *Analytical Chemistry* **74**(9), 2172 (2002).
- Y. G. Tan, H. Peng, C. D. Liang, L. H. Nie, S. Z. Yao, "A New Assay System for Phenacetin Using Biomimic Bulk Acoustic Wave Sensor with a Molecularly Imprinted Polymer Coating, Sensors and Actuators B," *Chemistry* **73**(2-3), 179 (2003).
- Y. G. Tan, J. Yin, C. D. Liang, H. Peng, L. H. Nie, S. Z. Yao, "A Study of a New TSM Bio-Mimetic Sensor Using a Molecularly Imprinted Polymer Coating and Its Application for the Determination of Nicotine in Human Serum and Urine," *Bioelectrochemistry* **53**(2), 141 (2001).
- C. D. Liang, H. Peng, L. Nie, S. Yao, "Bulk Acoustic Wave Sensor for Herbicide Assay Based on Molecularly Imprinted Polymer," *Fresenius's Journal of Analytical Chemistry* **376**(6), 551 (2000).
- C. D. Liang, H. Peng, L. Nie, S. Yao, "Molecular Imprinting Polymer Coated BAW Bio-Mimic Sensor for Direct Determination of Epinephrine," *Analytica Chimica Acta* **423**(2), 221 (2000).
- H. Peng, C. D. Liang, D. L. He, L. H. Nie, S. Z. Yao, "Bulk Acoustic Wave Sensor "Using Molecularly Imprinted Polymers as Recognition Elements for the Determination of Pyrimethamine," *Talanta* **52**(3), 441 (2000).
- H. Peng, C. D. Liang, D. L. He, L. H. Nie, S. Z. Yao, "Non-Aqueous Assay System for Phenobarbital Using Biomimetic Bulk Acoustic Wave Sensor Based on a Molecularly Imprinted Polymer," *Analytical Letters* **33**(5), 793 (2000).
- H. Peng, C. D. Liang, A. H. Zhou, Y. L. Zhang, Q. J. Xie, S. Z. Yao, "Development of a New Atropine Sulfate Bulk Acoustic Wave Sensor Based on a Molecularly Imprinted Electrosynthesized Copolymer of Aniline with O-Phenylenediamine," *Analytica Chimica Acta* **423**(2), 221 (2000).
- S. Z. Yao, H. Peng, C. D. Liang, Y. Wu, L. H. Nie, "Biomimetic Bulk Acoustic Wave Sensor for Determination of Trimethoprim in the Organic Phase Based on a Molecular Imprinting Polymer," *Analytical Sciences* **16**, 211 (2000).
- C. D. Liang, Y. B. Lin, Z. C. Liu, "Study of the Synthesis of Piper Acid by Air-Oxidation," *Xiangtan Daxue Xuebao* **21**(2), 59 (1999). **In Chinese*
- C. D. Liang, H. Peng, X. Bao, L. Nie, S. Yao, "Study of a Molecular Imprinting Polymer Coated BAW Bio-Mimic Sensor and Its Application to the Determination of Caffeine in Human Serum and Urine," *The Analyst* **124**, 1781 (1999).
- C. D. Liang, Y. B. Lin, Z. C. Liu, "Novel Synthetic Method of Thiophenine," *Xiangtan Daxue Xuebao* **20**(4), 60 (1998). **In Chinese*
- C. D. Liang, Y. B. Lin, Z. C. Liu, "Virtual Reality Modeling Language and Development of the Molecular Graph Maker System," *Computerized and Applied Chemistry* **14**(4), 317-319 (1997). **In Chinese*
- Z. C. Liu, Y. B. Lin, C. D. Liang, "Preparation of Copper Phthalocyanin in Solution of Methylidiphenylmethane," *Dye Industry* **5**, 16 (1997). **In Chinese*