

Curriculum Vitae

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Research Interests

- Nano/micro characterization of geomaterials: nanoindentation of clay minerals & shales; nanocompression of clay-biopolymer flocs (“marine snow”); 2D synchrotron XRD quantification of clay and shale microstructure (clay particle orientation); microscopy & imaging
- Clay-biopolymer interactions for coastal restoration and hydrofracking: drilling/hydrofracking fluid and shale/clay interactions; shale anti-softening
- Novel geopolymers in geotechnical applications (soil improvement, grouting)
- Superhydrophobic hybrid inorganic-organic polymers with high thermal and chemical resistance

Education

M.I.T.	Geotechnical & Geoenvironmental Eng. Minor in Materials Science	Ph.D.	2002
Tsinghua University	Geotechnical Engineering	M.S.	1994
Tsinghua University	Hydraulic Engineering	B.Eng.	1991
Tsinghua University	Mechanical Engineering	B.Eng.	1991

Professional Experience

2017 -	Professor	Univ. of Mass. Amherst
2013 – 2017	Associate Professor	Univ. of Massachusetts Amherst
2011 – 2013	Associate Professor	Louisiana State University
2005 – 2011	Assistant Professor	Louisiana State University
2004 Summer	Visiting Scholar	M.I.T.
2002 – 2005	Lecturer	University of Nottingham (UK)
1996 – 2002	Graduate Assistant	M.I.T.
1994 – 1996	Engineer	China Academy of Building Research
1991 – 1994	Graduate Assistant	Tsinghua University

Honors and Awards

- Chevron Innovative Research Support Award, LSU College of Eng., 2011
- Research Achievement Award, LSU Dept. of Civil & Environmental Eng., 2010
- Summer Faculty Research Fellowship, Office of Naval Research (ONR)/ASEE, 2010
- Faculty Achievement Award, LSU Dept. of Civil & Environmental Eng., 2008
- Donald W. Clayton Mentor Award, LSU College of Engineering, 2007
- Ralph E. Powe Junior Faculty Enhancement Award, Oak Ridge Associated Univ., 2006
- New Lecturer Award, University of Nottingham, 2002

- Fugro Fellowship, M.I.T., 1996
- Outstanding Contribution to Laboratories Award, Tsinghua University, 1994
- Excellent Graduate (1 award of 30 students), Tsinghua University, 1991
- Fluid Mechanics Scholarship of Hong Kong Tsinghua Alumni Fund, Tsinghua Univ., 1990
- Shi Jiayang Scholarship, Tsinghua University, 1989
- Excellent Students Award, 1987-1990

Patents

1. Reed, A.H., Zhang, G., Yin, H., and Young, D.C. (2015). System and method for testing of micro-sized materials. *US Patent* #: US 8,984,957 B2.

Publications

Book Chapters and Edited Books

1. Chen, Q., Ozeren, Y., Zhang, G., Wren, D., Wu, W., Jadhav, R., Parker, K., and Pant, H. (2013). Laboratory and field investigations of marsh edge erosion. In: *Sediment Transport: Monitoring, Modeling and Management*, A.A. Khan and W. Wu (eds.), Nova Science Publishers, Inc., Chapter 10. ISBN-13: 978-1626186835.
2. Zhang, G. and Liu, Z. (2014). *New Frontiers in Geotechnical Engineering*. Proceedings of the Geo-Shanghai International Conference, May 26-28, 2014. Geotechnical Special Publication No. 243, published by ASCS Geo-Institute.

Journal Articles

Research topic: Micro/nano characterization and nanoindentation of geomaterials

3. Luo, S., Lu, Y., Wu, Y., Song, J., DeGroot, D.J., Jin, Y., and Zhang, G. (2019). Cross-scale characterization of the elasticity of shales: statistical nanoindentation and big data analytics. *Journal of the Mechanics and Physics of Solids* (submitted).
4. Lu, Y., Li, Y., Wu, Y., Luo, S., Jin, Y., and Zhang, G. (2019). Characterization of shale softening by large volume-based nanoindentation. *Rock Mechanics and Rock Engineering* (accepted).
5. Zeng, Q., Wu, Y., Liu, Y., and Zhang, G. (2019). Determining the micro-fracture properties of Antrim gas shale by an improved micro-indentation method. *Journal of Natural Gas Science and Engineering* **62**, 224-235.
6. Ma, F., Song, J., Luo, S., DeGroot, D.J., Bai, X., and Zhang, G. (2019). Distinct responses of nanostructured layered muscovite to uniform and nonuniform straining. *Journal of Materials Science* **54**, 1077-1098.
7. Song, J., Sun, Q., Luo, S., Arwade, S.R., Gerasimidis, S., Guo, Y., and Zhang, G. (2018). Compression behavior of individual thin-walled metallic hollow spheres with patterned distributions of microscopy. *Materials Science and Engineering A*, **734**, 453-475.
8. Du, J., Hu, L., Meegoda, J.N., and Zhang, G. (2018). Shale softening: observations, phenomenological behavior, and mechanisms. *Applied Clay Science*, **161**, 290-300.
9. Yang, Z., Wang, L., Chen, Z., Xiang, D., Hou, D., Ho, C., and Zhang, G. (2018). Micromechanical characterization of fluid-shale interactions via nanoindentation. *SPE Reservoir Evaluation & Engineering: Formation Evaluation*, **21**, May 2018.

10. Song, J., Sun, Q., Yang, Z., Luo, S., Xiao, X., Arwade, S.R., Zhang, G. (2017). Effects of microporosity on the elasticity and yielding of thin-walled metallic hollow spheres. *Materials Science and Engineering A*, **688**, 134-145.
11. Hou, D., Zhang, G., Pant, R.J., Wei, Z., and Shen, S. (2016). Micromechanical properties of nanostructured clay-oxide multilayers synthesized by layer-by-layer self-assembly. *Nanomaterials*, **6**(11), 204; doi:10.3390/nano6110204.
12. Hou, D., Zhang, G., Pant, R.J., Shen, J.S., Liu, M., and Luo, H. (2016). Nanoindentation of a ternary clay-based composite used in Chinese ancient construction. *Materials*, **9**, 866; doi:10.3390/ma9110866.
13. Tan, X., Liu, F., Hu, L., Reed, A.H., Furukawa, Y., and Zhang, G. (2017). Evaluation of the particle sizes of four clay minerals. *Applied Clay Science*, **135**, 313-324.
14. Luo, S., Hou, D., and Zhang, G. (2016). Comment on "Measurement of the elastic properties of swelling clay minerals using the digital image correlation method on a single macroscopic crystal", by S. Hedan, F. Hubert, D. Prêt, E. Ferrage, V. Valle, P. Cosenza [Applied Clay Science 116 - 117 (2015), 248-256, doi: 10.1016/j.clay.2015.04.002]. *Applied Clay Science* (in press, available online).
15. Wu, H., Hu, L., Zhang, G. (2016). Effects of electro-osmosis on the physical and chemical properties of bentonite. *ASCE Journal of Materials in Civil Engineering* **28**(8), 06016010-1 to 6.
16. Liu, Z., Liu, F., Ma, F., Wang, M., Bai, X., Zheng, Y., Yin, H., and Zhang, G. (2016). Collapsibility, composition, and microstructure of a loess in China. *Canadian Geotechnical Journal*, **53**(4), 673-686.
17. Zhang, G., Yin, H., and DeGroot, D.J. (2013). Thixotropism of micron-sized saltwater clay flocs. *Geotechnique Letters* 3, 162-165.
18. Zhang, J., Hu, L., Pant, R., Yu, Y., Wei, Z., and Zhang, G. (2013). Effects of interlayer interactions on the nanoindentation behavior and hardness of 2:1 phyllosilicates. *Applied Clay Science* **80-81**, 267-280.
19. Yin, H. and Zhang, G. (2011). Nanoindentation behavior of muscovite subjected to repeated loading. *Journal of Nanomechanics and Micromechanics*, 1 (2), 72-83.
20. Chen, H., Zhang, G., Wei, Z., Cooke, K.M., and Luo, J. (2010). Layer-by-layer assembly of sol-gel oxide "glued" montmorillonite-zirconia multilayers. *Journal of Materials Chemistry*, **20**, 4925-4936.
21. Zhang, G., Wei, Z., Ferrell, R.E., Guggenheim, S., Cygan, R.T., and Luo, J. (2010). Evaluation of the elasticity normal to the basal plane of non-expandable 2:1 phyllosilicate minerals by nanoindentation. *American Mineralogist*, **95**, 863-869.
22. Wei, Z., Zhang, G., Chen, H., Luo, J., Liu, R., and Guo, S. (2009). A simple method for evaluating elastic modulus of thin films by nanoindentation. *Journal of Materials Research*, **24**, 801-815.
23. Chen, H., Zhang, G., Richardson, K., and Luo, J. (2008). Synthesis of nanostructured nanoclay-zirconia multilayers: a feasibility study. *Journal of Nanomaterials 2008*, doi:10.1155/2008/749508.
24. Zhang, G., Wei, Z., and Ferrell, R.E. (2009). Elastic modulus and hardness of muscovite and rectorite determined by nanoindentation. *Applied Clay Science*, **43**, 271-281.
25. Zhang, G., Wei, Z., and Ferrell, R.E. (2009). Reply to comment on "elastic modulus and hardness of muscovite and rectorite determined by nanoindentation". *Applied*

Clay Science, **46**, 429-432.

26. Zhang, G., Germaine, J.T., Whittle, A.J. and Ladd, C.C. (2004). Soil structure of a highly weathered old alluvium. *Géotechnique*, **54** (7), 453-466.
27. Zhang, G., Germaine, J.T., Martin, R.T., and Whittle, A.J. (2003). A simple sample mounting method for random powder X-ray diffraction. *Clays and Clay Minerals*, **51** (2), 219-226.

Research topic: Geopolymers and Cements

28. Zhao, M., Zhang, G., Htet, K.W., Kwon, M., Liu, C., Xu, Y., and Tao, M. (2019). Freeze-thaw durability of red mud slurry-Class F fly ash-based geopolymer: Effect of curing conditions. *Construction and Building Materials*, **215**, 381-390.
29. Hou, D., Li, D., Hua, P., Jiang, J., and Zhang, G. (2019). Statistical modeling of compressive strength controlled by porosity and pore size distribution for cementitious materials. *Cement and Concrete Composites*, **96**, 11-20.
30. Zhang, M., Zhao, M., Zhang, G., Sietins, J.M., Granados-Focil, S., Pepi, M.S., Xu, Y., and Tao, M. (2018). Reaction kinetics of red mud-fly ash based geopolymers: Effects of curing temperature on chemical bonding, porosity, and mechanical strength. *Cement and Concrete Composites*, **93**, 175-185.
31. Zhang, M., Deskins, N., Zhang, G., Cygan, R., and Tao, M. (2018). Modeling the polymerization process for geopolymer synthesis through reactive molecular dynamic simulations. *Journal of Physical Chemistry C*, **122**(12), 6760-6773.
32. Zhang, M., Zhao, M., Zhang, G., El-Korchi, T., and Tao, M. (2017). A multiscale investigation of reaction kinetics, phase formation, and mechanical properties of metakaolin geopolymers. *Cement and Concrete Composites*, **78**, 21-32.
33. Zhang, M., Zhao, M., Zhang, G., El-Korchi, T., and Tao, M. (2016). Durability of red mud-fly ash based geopolymer and leaching behavior of heavy metals in sulfuric acid solutions and deionized water. *Construction & Building Materials*, **124**, 373-382.
34. Zhang, M., Zhao, M., Zhang, G., Nowak, P., Coen, A., Tao, M. (2015). Calcium-free geopolymer as a stabilizer for sulfate-rich soils. *Applied Clay Science* **108**, 199-207.
35. Zhang, M., El-Korchi, T., Zhang, G., Liang, J., and Tao, M. (2014). Synthesis factors affecting the mechanical properties, microstructure, and chemical composition of red mud-fly ash based geopolymers. *Fuel*, **134**, 315-325.
36. Zhang, M., Guo, H., El-Korchi, T., Zhang, G., and Tao, M. (2013). Experimental feasibility study of geopolymer as the next-generation soil stabilizer. *Construction and Building Materials* **47**, 1468-1478.
37. He, J., Jie, Y., Zhang, J., Yu, Y., and Zhang, G. (2013). Synthesis and characterization of red mud and rice husk ash-based geopolymer composites. *Cement and Concrete Composites* **37**, 108-118.
38. He, J., Zhang, J., Yu, Y., and Zhang, G. (2012). The strength and microstructure of two geopolymers derived from metakaolin and red mud-fly ash admixture: a comparative study. *Construction and Building Materials* **30**, 80-91.
39. He, J., Zhang, G., Hou, S., and Cai, C.S. (2011). Geopolymer-based smart adhesives for infrastructure health monitoring: concept and feasibility. *ASCE Journal of Materials in Civil Engineering*, **23** (2), 100-109.
40. Zhang, G., He, J., and Gambrell, R.P. (2010). Synthesis, characterization, and

mechanical properties of red mud-based geopolymers. *Journal of Transportation Research Board*, **2167**, 1-9.

Research topic: Biopolymer-clay interactions

41. Liu, C., Liu, F., Song, J., Ma, F., and Zhang, G. (2019). Effect of substrates on the evaluation of elasticity, yielding, and crushing of individual sand particles. *Geotechnical Testing Journal* (submitted).
42. Lukas, W., DeGroot, D.J., DeJong, J.T., Krage, C.P., and Zhang, G. (2019) Undrained shear behavior of low-plasticity intermediate soils under simulated tube sampling disturbance. *Journal of Geotechnical and Geoenvironmental Engineering* **145**, 04018098-1-11.
43. Zhang, Z., Liu, F., and Zhang, G. (2015). An effective stress formulation for unsaturated soils considering air-liquid interface. *Rock and Soil Mechanics*, **36**, 147-153.
44. Zhang, Z., Liu, F., and Zhang, G. (2014). Models for water retention and unsaturated permeability in full range of water content. *Chinese Journal of Geotechnical Engineering*, *36*(11), 2069-2077.
45. Furukawa, Y., Reed, A.H., and Zhang, G. (2014). Effect of organic matter on estuarine flocculation: a laboratory study using montmorillonite, humic acid, xanthan gum, guar gum and natural estuarine flocs. *Geochemical Transactions* 15, 1-9.
46. Zhang, Z., Liu, F., Zhang, G., and Zheng, F. (2013). Microscopic hydraulic behavior from the interactions between uneven-sized wet particles and liquid bridge. *Chinese Journal of Hydraulics*, **44**(7), 810-817.
47. Zhang, Z., Liu, F., and Zhang, G. (2013). A physical hysteresis boundary water retention model for uniform wet particulate material. *Chinese Journal of Hydraulics*, **44**(10), 1165-1174.
48. Wang, F., Zhang, L., Zhang, G., and Zhang, H. (2013). Mapping and spatial analysis of multiethnic toponyms in Yunnan, China. *Cartography and Geographic Information Science*, 41 (1), 86-99.
49. Zhang, G., Yin, H., Lei, Z., Reed, A.H., and Furukawa, Y. (2013). Effects of exopolymers on particle size distributions of suspended cohesive sediments. *Journal of Geophysical Research: Oceans* **118** (7), 3473-3489, doi:10.1002/jgrc.20263.
50. Tan, X., Hu, L., Reed, A.H., Furukawa, Y., and Zhang, G. (2014). Flocculation and particle size analysis of expansive clay sediments affected by biological, chemical, and hydrodynamic factors. *Ocean Dynamics* **64** (1), 143-157.
51. Tan, X., Zhang, G., Yin, H., Reed, A.H., and Furukawa, Y. (2012). Influence of a neutral exopolymer on the flocculation and settling velocity of cohesive sediments. *International Journal of Sediment Research* **27** (4), 473-485.
52. Ye, Z., Hohamadian, H., Yin, H., Zhang, G., and Pang, S.-S. (2009). Advancing laboratory education in control engineering with practical implementation approaches. *WSEAS Transactions on Advances in Engineering Education*, **6** (2), 55-65.
53. Nugent, R.A., Zhang, G., and Gambrell, R.P. (2009). Effect of exopolymers on the liquid limit of clays and its engineering implications. *Journal of Transportation Research Board*, **2101**, 34-43.