

## 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**

- Overseas Collaborative Research Award, NSFC, 2012
- 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. 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*, accepted.
4. 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.
5. 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.
6. 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.
7. 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.

8. 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).
9. 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.
10. 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.
11. Zhang, G., Yin, H., and DeGroot, D.J. (2013). Thixotropism of micron-sized saltwater clay flocs. *Geotechnique Letters* 3, 162-165.
12. 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.
13. Yin, H. and Zhang, G. (2011). Nanoindentation behavior of muscovite subjected to repeated loading. *Journal of Nanomechanics and Micromechanics*, 1 (2), 72-83.
14. 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.
15. 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.
16. 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.
17. 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.
18. 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.
19. 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.
20. 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.
21. 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

22. 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* (accepted).
23. 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.
  24. 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.
  25. 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.
  26. 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.
  27. 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.
  28. 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.
  29. 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.
  30. 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.
  31. 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

32. 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.
33. 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.
34. 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.
35. 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.
36. 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.

37. 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.
38. 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.
39. 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.
40. 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.
41. 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.
42. 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.
43. Hau, K.W., McDowell, G.R., Zhang, G. and Brown, S.F. (2005). The application of a three-surface kinematic hardening model to repeated loading of thinly surfaced pavements. *Granular Matter*, **7**, 145-156.
44. Yu, H., Khong, C.D., Wang, J. and Zhang, G. (2005). Experimental evaluation and extension of a simple critical state model for sand. *Granular Matter*, **7**, 213-225.
45. Zhang, G., Germaine, J.T. and Whittle, A.J. (2005). An evaluation of the mechanical and chemical dispersion methods for a tropical old alluvium. *ASTM Geotechnical Testing Journal*, **28** (2), 123-132.
46. Zhang, G., Germaine, J.T., Whittle, A.J. and Ladd, C.C. (2004). Index properties of a highly weathered old alluvium, *Géotechnique*, **54** (7), 441-451.
47. Zhang, G., Germaine, J.T., and Whittle, A.J. (2003). Effects of Fe-oxides cementation on the deformation characteristics of a highly weathered old alluvium in San Juan, PR. *Soils and Foundations*, **43** (4), 119-130.
48. Wang, H., Zhang, G. and Zhou, K. (1996). Effects of inherent and induced anisotropy on the strength and deformation characteristics of a compacted clay. *Chinese Journal of Geotechnical Engineering*, **18** (3), 1-10.