He (Richard) Zhao *hzhao@u.northwestern.edu*

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Education

Northwestern University Evanston, IL
Ph.D. Candidate in Mechanical Engineering *Expected 2017*
Advisor: Prof. L. Catherine Brinson, GPA: 3.98
University of Notre Dame Notre Dame, IN
Bachelor of Science in Aerospace Engineering *2008 - 2012*

Experience

Northwestern University, Research Assistant at Advanced Materials Lab Sept '12 - present

Materials Informatics Analysis in Polymer Nanocomposites

Data infrastructure (MongoDB) and web interface (Python Django) are constructed to analyze nanocomposites materials data. Unstructured experimental and computational research data is extracted and curated from literature and lab apparatus using image analysis, nature language processing and REST-API. Clustering methods are implemented as web apps to find correlations among parameters in processing, structure and property domains for performance optimization and material design.

Finite Element Analysis of Polymer Nanocomposites

Novel viscoelasticity-inspired constitutive model of dielectric constant is developed to model composite dielectric interphase and spectroscopy. Stochastic model based on electron trapping is constructed to represent dielectric breakdown propagation in 2D/3D composite medium. Both models are implemented using COMSOL multiphysics with automated scripts (Java, python) to study influence of constituents, microstructure and interphase on composite properties.

National Institute of Material Science (Japan), Visiting Scholar July – Oct '14

Worked in the Materials Information Station to evaluate and upgrade web-based thermophysics property prediction system. Developed data schema and knowledge representation rules for polymer materials.

University of Notre Dame, Research Assistant May - Sep '10

Worked as a summer summer on mineral-collagen material synthesis and quantitative elemental analysis for artificial bone graft substitutes that leads to enhanced mechanical strength.

Mentoring and Teaching Experience

Mentoring

- Yixing Wang (Ph.D student, Spring '15 – present): nanodielectric finite element models
- Wen Luo (M.S. student, Fall '14 – Spring '15): nanocomposite microstructure analysis

- Karen Qu, Mathias Schmutz (B.S. student, Summer 2015): data curation from literature

Teaching Assistant

- ME456: Mechanics of Advanced Materials (Winter 2016): TA and grader
- GEN_ENG Engineering Analysis 3: Dynamic Systems (Spring 2015): Lead teaching assistant
  Coordinate schedule and tasks of eight TAs for 400+ freshmen course. Prepared assignments and recitation materials. Lead lecture discussion and tutorial sessions.

Selected Journal Articles

Full list and PDFs available at http://hzhao1230.github.io/publications

- **Zhao, H.,** Li, Y., Huang, Y., Schadler, L.S., Brinson, L.C., Dielectric Spectroscopy Analysis using Viscoelasticity-inspired Relaxation Theory with Finite Element Modeling. (Under review)
- **Zhao, H.**, Li, X., Zhang, Y., Schadler, L.S., Chen, W. and Brinson, L.C., 2016. NanoMine: A material genome approach for polymer nanocomposites analysis and design. *APL Materials*, *4*(5)
- Zhang, Y., **Zhao, H.**, Hassinger, I., Brinson, L.C., Schadler, L.S. and Chen, W., 2015. Microstructure reconstruction and structural equation modeling for computational design of nanodielectrics. *Integrating Materials and Manufacturing Innovation*, *4*(1), pp.1-26.
- Hassinger, I., Li, X., **Zhao, H.**, Xu, H., Huang, Y., Prasad, A., Schadler, L., Chen, W. and Brinson, L.C., 2016. Toward the development of a quantitative tool for predicting dispersion of nanocomposites under non-equilibrium processing conditions. *Journal of Materials Science*, *51*(9)
- Biswas, A., Ovaert, T.C., Slaboch, C., **Zhao, H.**, Bayer, I.S., Biris, A.S. and Wang, T., 2011. Mineral concentration dependent modulation of mechanical properties of bone-inspired bionanocomposite scaffold. *Applied Physics Letters*, *99*(1)
- Biswas, A., Bayer, I.S., **Zhao, H.**, Wang, T., Watanabe, F. and Biris, A.S., 2010. Design and synthesis of biomimetic multicomponent all-bone-minerals bionanocomposites. *Biomacromolecules*, *11*(10)

Selected Conference Proceedings (* peer-reviewed)

Full list and PDFs available at http://hzhao1230.github.io/publications

- **Zhao, H.**, Li. X., Schadler, L.S., Chen, W., Brinson, L.C., NanoMine: An Integrated System for Material Informatics of Polymer Composites. *Material Research Society (MRS) Fall Meeting*, December 2015, Boston, MA
- **Zhao, H.**, Hu. A., Brinson, L.C., Bostanabad, R., Xu, H., Chen, W., Identification of Key Microstructure Features in the Design of Nanocomposites. *13th US National Congress on Computational Mechanics (USNCCM13)*. August, 2015. San Diego, CA
- **Zhao, H.,** Li, Y., Brinson, L.C., Application of Finite Element Modeling and Viscoelasticity Theory in Characterization and Prediction of Dielectric Relaxation Process in Polymer Nanodielectrics. *Society of Engineering Science (SES) Technical Meeting*, October 2014, West Lafayette, IN
- *Huang, Y., Li, Y., **Zhao, H.**, Schadler. L.S., Brinson, L.C., *et al.* Prediction of Interface Dielectric Relaxations in Bimodal Brush Functionalized Epoxy Nanodielectrics by Finite Element Analysis Method. *IEEE Electric Insulation and Dielectric Phenomena (CEIDP)*, October, 2014, Des Moines, IA

- **Zhao, H**., Biswas, A. Design and Fabrication of Nanocomposites for Advanced Technology Applications. *Toward Regulation of Nanomaterials*, May, 2010, Notre Dame, IN
- Biswas, A., **Zhao, H**., Bayer, I., Biris, I. S., Bone-Inspired Multicomponent Bionanocomposites with a Simple Drop-cast Processing Strategy. *Material Research Society (MRS) Spring Meeting*, April 2011, San Francisco, CA

Skills

- **Programming**: Proficient with Python, Matlab, R, Linux Shell, SQL, mongoDB. Experience with Java, C++, SAS
- **Simulation**: Proficient with COMSOL, Abaqus. Experience with Hyperworks, ISight

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Awards

- Predictive Science and Engineering Design (PSED) Fellowship — Sep '14
- Murphy Graduate Fellowship — Sep '12
- Nanoscience Undergraduate Research Fellowship — Mar '10
- Full Ride University Scholarship — 2008-2012