

# He (Richard) Zhao

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## Education

<b>Northwestern University</b>	Evanston, IL
Ph.D. Candidate in Mechanical Engineering	<i>Expected Jun 2017</i>
Advisor: Prof. L. Catherine Brinson, GPA: 3.92	
M.S. Candidate in Computer Science	<i>Expected Jun 2017</i>
<b>University of Notre Dame</b>	Notre Dame, IN
Bachelor of Science in Aerospace Engineering	2012

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## Research Experience

[Northwestern University](#), Research Assistant at [Advanced Materials Lab](#) Sept '12 - present

### Materials Informatics Analysis in Polymer Nanocomposites

Lead developer for "NanoMine", an online data resource and community-based platform for polymer nanocomposite research. Data infrastructure (MongoDB) and web interface (Python Django) are constructed to curate and analyze materials data. Unstructured experimental and computational research data is extracted and curated from literature and lab apparatus using image analysis, online publication text crawling, nature language processing and RESTful 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

Design and implement an inverse regression-based heuristic model coupled with physics-based finite element modeling for nanocomposite materials mechanical and dielectric property prediction with ABAQUS and COMSOL. Novel viscoelasticity-inspired constitutive model of dielectric constant is developed to model composite dielectric interphase and spectroscopy. Models are implemented with automated scripts (Java, python) to study influence of constituents, microstructure and interphase on composite properties.

[National Institute of Material Science \(Japan\)](#), Visiting Scholar Jul – 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 - Sept '10

Summer undergraduate research on mineral-collagen material synthesis and quantitative elemental analysis for artificial bone graft substitutes that leads to enhanced mechanical strength.

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## Profession Experience

SkinIO, Software Engineer

Jun '16 - present

Design and implement from scratch a Python machine learning module for skin cancer image analysis at a biotech startup. Apply transfer learning with convolutional neural network in Caffe that achieves 90.4 % skin lesion classification accuracy. Work within DevOps team to deploy machine learning component using AWS EC2 and Elastic Beanstalk for production. Develop data collection workflow using AWS DynamoDB and Elastic Beanstalk in an AngularJS web app. Improve feature extractions with data-driven approach from temporal full-body computer vision analysis using OpenCV.

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## Mentoring and Teaching Experience

### Mentoring

- Yixing Wang (Ph.D student, Spring '15 – present): nanodielectric finite element models
- Zijiang Yang (Ph.D student, Summer '16): web applications for NanoMine
- 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. Led lecture discussion and tutorial sessions.
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## 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)

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## 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. *13<sup>th</sup> 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

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## Skills

- **Programming:** Python, Java, C++, MATLAB, UNIX Shell, HTML/CSS, SQL, JavaScript, R, SAS
- **Platforms:** Amazon Web Services, CentOS, Debian, MongoDB, MySQL, Django, Git/Bitbucket, Node.js, AngularJS
- **Simulation:** COMSOL, ABAQUS, 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

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## Other Academic Activities

- Paper reviewer for MRS Bulletin, IJBIC
- Invited speaker at 2015 US-Japan Materials Data Consortium, 2016 International Data & Analytics for Materials Research Summit
- Guest/visiting scholar at US Nat'l Institute of Standards and Technology and Japan Nat'l Institute of Materials Science