

# Matthew A. Gebbie

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GLAM Postdoctoral Fellow  
Materials Science & Engineering  
Stanford University, Stanford, CA 94305  
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## Positions

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- January 2020 **Assistant Professor**, Department of Chemical and Biological Engineering  
University of Wisconsin-Madison, WI
- 2016 – 2019 **GLAM Fellowship**, Geballe Laboratory for Advanced Materials  
Stanford University, CA

## Education

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- 2010 – 2016 **University of California**, Santa Barbara, CA  
Ph.D. in Materials  
Advisor: Prof. **Jacob N. Israelachvili**  
*Thesis Title: Tuning electrostatic interactions in confined soft matter*
- 2005 – 2010 **North Carolina State University**, Raleigh NC  
B.S. in Chemical Engineering, *cum laude*  
Minor in Business Administration

## Research Experience

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- 2016 – 2019 **GLAM Fellow**, Stanford University  
Geballe Laboratory for Advanced Materials and Materials Science & Engineering  
Advisor: Prof. **Nicholas A. Melosh**  
*Diamond nanomaterials for advanced bio-imaging and electric field sensing*  
*Collaboration with Chemistry and Applied Physics groups*
- 2010 – 2016 **Graduate Student Researcher**, University of California at Santa Barbara  
Materials Department and Materials Research Laboratory  
Advisor: Prof. **Jacob N. Israelachvili**  
*Discovered new mechanism of electrostatic screening in ionic liquids*  
*Explored molecular design principles for bio-inspired underwater adhesives*  
*Procter & Gamble collaboration, molecular self-assembly*
- 2009 – 2010 **Undergraduate Researcher**, North Carolina State University  
Department of Chemical & Biomolecular Engineering  
Advisor: Prof. Wesley A. Henderson (currently at *Army Research Office*)  
*Synthesized novel ionic liquids, aromatic dissolution in ionic liquids*

## Peer-Reviewed Publications

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15. **Gebbie MA**, Ishiwata H, McQuade P, Petrak V, Taylor A, Dahl J, Carlson RMK, Fokin AA, Schreiner PR, Shen ZX, Nesladek M, Melosh NA. Experimental measurement of the diamond nucleation

landscape reveals classical and nonclassical features. *Proc. Natl. Acad. Sci. USA* 115, 8284 – 8289 (2018).

**DOE-SLAC Research Highlight, August 2018**

14. **Gebbie\*** MA, Smith A, Dobbs HA, Lee A, Warr G, Banquy X, Valtiner, M, Rutland\* M, Israelachvili\* JN, Perkin\* S, Atkin\* R. Long range electrostatic forces in ionic liquids. *Chem. Comm.* 53, 1214 – 1224 (2017). \* - **Co-corresponding authorship.**

**Invited Feature Review**

13. **Gebbie\*** MA, Wei\* W, Schrader AM, Cristiani T, Waite JH, Israelachvili JN. Tuning underwater adhesion with cation- $\pi$  interactions. *Nature Chemistry* 9, 473 – 479 (2017). \* - Equal contribution.

**Highlighted in Chemical & Engineering News, February 2017**

12. Banquy X, Lee DW, Kristainsen K, **Gebbie MA**, Israelachvili JN. Interaction forces between supported lipid bilayers in presence of PEGylated polymers. *Biomacromolecules* 17, 88 – 97 (2016).

11. Rapp MV, Donaldson SH, **Gebbie MA**, Gizaw Y, Koenig P, Roiter Y, Israelachvili JN. The effects of surfactants and polyelectrolytes on the interaction between a negatively charged surface and a hydrophobic polymer surface. *Langmuir* 31, 8013 – 8021 (2015).

10. **Gebbie MA**, Dobbs HA, Valtiner M, Israelachvili JN. Long-range electrostatic screening in ionic liquids. *Proc. Natl. Acad. Sci. USA* 112, 7432 – 7437 (2015).

9. Donaldson SH, Røyne A, Kristiansen K, Rapp MV, Das S, **Gebbie MA**, Lee DW, Stock P, Valtiner M, Israelachvili JN. Developing a general interaction potential for hydrophobic and hydrophilic interactions. *Langmuir* 31, 2051 – 2250 (2015).

**Cover Article February 24, Invited Feature Article**

8. Wei\* W, Yu\* J, **Gebbie\*** MA, Tan Y, Martinez Rodriguez NR, Israelachvili JN, Waite JH. The bridging adhesion of mussel-inspired peptides: role of charge, chain length, and surface type. *Langmuir* 31, 1105 – 1112 (2015). \* - Equal contribution.

7. Rapp MV, Donaldson SH, **Gebbie MA**, Das S, Kaufman Y, Gizaw Y, Koenig PH, Roiter Y, Israelachvili JN. Hydrophobic, electrostatic, and dynamic polymer forces at polysurfactant-modified silicone surfaces. *Small* 11, 2058 – 2068 (2015).

6. Donaldson SH, Utzig T, **Gebbie MA**, Raman S, Shrestha BR, Israelachvili JN, Valtiner M. Electrochemical control of specific adhesion between amine-functionalized polymers and noble metal electrode interfaces. *Matrl. Corr.* 65, 362 – 369 (2014).

5. Israelachvili JN, Kristiansen K, **Gebbie MA**, Lee DW, Donaldson SH, Das S, Rapp MV, Banquy X, Valtiner M, Yu J. The intersection of interfacial forces and electrochemical reactions. *J. Phys. Chem. B* 117, 16369 – 16387 (2013).

**Cover Article December 26, Invited Feature Review**

4. Donaldson SH, Das S, **Gebbie MA**, Rapp MV, Jones LC, Roiter Y, Koenig PH, Gizaw Y, Israelachvili JN. Asymmetric electrostatic and hydrophobic-hydrophilic interaction forces between mica surfaces and silicone polymer thin films. *ACS Nano* 7, 10094 – 10104 (2013).

- 3b. **Gebbie MA**, Valtiner M, Banquy X, Henderson WA, Israelachvili JN. Reply to Perkin et al.: Experimental observations demonstrate that ionic liquids form both bound (Stern) and diffuse electric double layers. *Proc. Natl. Acad. Sci. USA* 110, E4122 (2013).

- 3a. **Gebbie MA**, Valtiner M, Banquy X, Fox ET, Henderson WA, Israelachvili JN. Ionic liquids behave as dilute electrolyte solutions. *Proc. Natl. Acad. Sci. USA* 110, 9674 – 9679 (2013).

**DOE Basic Energy Sciences Research Highlight, June 2013**

2. Donaldson SH, Valtiner M, **Gebbie MA**, Harada J, Israelachvili JN. Interactions and visualization of bio-mimetic membrane detachment at smooth and nano-rough gold electrode surfaces. *Soft Matter* 9, 5231 – 5238 (2013).
1. Valtiner M, Donaldson SH, **Gebbie MA**, Israelachvili JN. Hydrophobic forces, electrostatic steering, and acid-base bridging between atomically smooth self-assembled monolayers and end-functionalized PEGolated lipid bilayers. *J. Am. Chem. Soc.* 134, 1746 – 1753 (2011).

## Selected Honors and Awards

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- 2017      **Victor K. LaMer Award Finalist**, ACS Colloids Division  
Recognizes “an outstanding Ph.D. thesis accepted by a U.S. or Canadian university during the three year period prior to the award year.”
- 2016      **2016 – 2018 GLAM Postdoctoral Fellowship**, Stanford University  
Two fellowships awarded from among applicants in science, engineering, and medicine.
- 2015      **2015 Lindau Nobel Laureate Interdisciplinary Meeting**, NSF Delegate  
One of 25 NSF delegates, out of all graduate students in science, engineering, and medicine who have received US federal funding during the previous five years.
- 2011 – 2015      **Science and Engineering Fellow**, NSF Center for Nanotechnology in Society at UCSB  
**Co-author on 2 peer reviewed social science publications** on science policy, seminars on nanotechnology and nanoscience for social science and humanities researchers.
- 2015      **GradSlam Finalist**, University of California at Santa Barbara, Graduate Division  
Recognized as one of 10 finalists in a competition to present the best 3 minute research pitch, 82 participants from all campus disciplines, 3 competitive rounds.
- 2014      **“Outstanding Poster” Award**, Surface Forces Apparatus Conference 2014
- 2011      **NSF Graduate Research Fellowship**, Honorable Mention

## Invited Oral Presentations

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The importance of interfaces: using ionic liquids and nanodiamonds to explore new concepts in materials design. *Department Seminar*, Chemical Engineering, Stanford (March 2019).

The importance of interfaces: using ionic liquids and nanodiamonds to explore new concepts in materials design. *Department Seminar*, Materials Science & Engineering, UC Berkeley (February 2019).

The importance of interfaces: using ionic liquids and nanodiamonds to explore new concepts in materials design. *Materials Research Lecture Series*, California Institute of Technology (February 2019).

The importance of interfaces: using ionic liquids and nanodiamonds to explore new concepts in materials design. *Department Seminar*, Chem. and Bio. Engineering, Colorado School of Mines (February 2019).

The importance of interfaces: using ionic liquids and nanodiamonds to explore new concepts in materials design. *Department Seminar*, Mork Family Department, Univ. of Southern California (February 2019).

The importance of interfaces: using ionic liquids and nanodiamonds to explore new concepts in materials design. *Department Seminar*, Chem. Engineering & Materials Science, UMinnesota (February 2019).

The importance of interfaces: using ionic liquids and nanodiamonds to explore new concepts in materials design. *Department Seminar*, Chemical and Biomolecular Engineering, UC Berkeley (January 2019).

The importance of interfaces: using ionic liquids and nanodiamonds to explore new concepts in materials design. *ChBE Seminar Series*, Chemical and Biomolecular Engineering, Georgia Tech (January 2019).

The importance of interfaces: using ionic liquids and nanodiamonds to explore new concepts in materials design. *ChE Seminar Series*, McKetta Department of Chem. Eng., UT Austin (January 2019).

The importance of interfaces: using ionic liquids and nanodiamonds to explore new concepts in materials design. *Department Seminar*, Chemical Engineering, University of Florida (January 2019).

The importance of interfaces: using ionic liquids and nanodiamonds to explore new concepts in materials design. *Department Seminar*, Chemical & Biological Engineering, UW-Madison (December 2018).

Tuning electrostatic forces in ionic liquids and mapping the nucleation landscape of diamond. *ChBE Seminar Series*, Chemical & Biological Engineering, Northwestern University (February 2018).

Assessing nucleation theory under extreme conditions. *ABC...z Seminar Series*, Physics Department, University of California, Santa Barbara (October 2017).

Tuning electrostatic interactions in confined soft matter. *91<sup>st</sup> ACS Colloids and Surface Science Symposium*, The City College of New York (July 2017).

#### **LaMer Keynote Lecture**

Tuning underwater adhesion with cation- $\pi$  interactions. *Materials Research Outreach Program 2016*, University of California, Santa Barbara (February 2016).

Ionic liquids and water: the surprising connection. *Gordon Research Seminar: Chemistry and Physics of Liquids*, Holderness, NH (August 2015).

Salt water and ionic liquids: the surprising connection. *2015 STEMposium*, University of California, Santa Barbara (May 2015).

Ionic Liquids and dilute electrolytes: the surprising connection. *Liquids 2014: 9<sup>th</sup> Liquid Matter Conference*, Universidade de Lisboa, Lisbon, Portugal (July 2014).

Salt water and ionic liquids: the surprising connection. *Chemical Sciences Student Seminar 2013*, University of California, Santa Barbara (October 2013).

### **Selected Contributed Presentations**

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#### **Oral Presentations (21 Total Contributed Conference Oral Presentations)**

Mapping the diamond nucleation landscape to test classical nucleation theory. *92<sup>nd</sup> ACS Colloids and Surface Science Symposium*, Pennsylvania State University, University Park, PA (June 2018).

Ionic liquids and dilute electrolytes: the surprising connection. *92<sup>nd</sup> ACS Colloids and Surface Science Symposium*, Pennsylvania State University, University Park, PA (June 2018).

Tuning underwater adhesion with cation- $\pi$  interactions. *92<sup>nd</sup> ACS Colloids and Surface Science Symposium*, Pennsylvania State University, University Park, PA (June 2018).

Experimentally assessing nucleation theory at the molecular level. *Materials Research Society, 2017 Fall Meeting*, Boston, MA (November 2017).

Tuning biomolecular assembly with cation- $\pi$  interactions. *Materials Research Society, 2017 Fall Meeting*, Boston, MA (November 2017).

Long range electrostatic screening in ionic liquids. *American Institute of Chemical Engineers, 2017 Annual Meeting*, Minneapolis, MN (November 2017).

Tuning underwater adhesion with cation- $\pi$  interactions. *American Institute of Chemical Engineers, 2017 Annual Meeting*, Minneapolis, MN (November 2017).

### Poster Presentations (6 Total Contributed Poster Presentations)

Directly measuring the diamond nucleation landscape to test classical nucleation theory. *Frontiers of Molecular Engineering*, University of Chicago, Chicago, IL (September 2018).

Experimentally assessing nucleation theory at the atomic level. *Gordon Research Conference: Crystal Growth and Assembly*, Biddeford, ME (June 2017).

Ionic liquids and water: the surprising connection. *Gordon Research Conference: Chemistry and Physics of Liquids*, Holderness, NH (August 2015).

Ionic Liquids and dilute electrolytes: the surprising connection. *Surface Forces Apparatus Conference 2014*, Cancun, Mexico (August 2014).

### Proposal Writing Experience

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(\$2.68m) Co-wrote, Diamondoid science and Applications, U.S. DOE Field Work Proposal, Stanford Institute for Materials and Energy Sciences; Submitted 2018.

(\$150k) Author, Developing diamond nanomaterials to enable advanced bio-imaging and electric field sensing, GLAM Postdoctoral Fellowship, Stanford University, Stanford CA; Awarded 2016.

(\$50k) Co-wrote, Molecular motifs for bio-inspired underwater adhesives, MRL IRG-1 Proposal, NSF Center at UCSB; Awarded to J. Israelachvili 2015.

(\$846k) Co-wrote, Relationship between the chemistry and physical interaction forces between closely apposed surfaces in liquids, DOE Renewal DE-FG02-87ER 45331; Awarded to J. Israelachvili 2014.

(\$50k) Co-wrote, Novel approaches to investigate fundamental binding mechanisms in bio-inspired adhesive systems, MRL IRG-1 Proposal, UCSB NSF Center; Awarded to J. Israelachvili 2014.

(\$50k) Co-wrote, Characterization of bio-inspired adhesives and lubricants for medical applications, MRL IRG-1 Proposal, UCSB NSF Center; Awarded to J. Israelachvili 2013.

(\$544k) Co-wrote, Multi-modal instrument for monitoring of membrane defect domains and adhesion, NIH R21 Proposal, RFA-GM-13-010; Submitted 2012, later used as basis for successful DOE proposal.

### Teaching and Mentoring

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2014 **Teaching Assistant**, UCSB, Colloids & Interfaces I, graduate, 20 students.

2013 **Instructor**, School for Scientific Thought, California NanoSystems Institute, UCSB **Designed and instructed** a 5 week course, "Experiencing nano-scale objects in everyday life." 22 high school students, lectures, discussion, labs, molecular science of daily life.

2011 – 2015 Developed and taught annual summer courses on nanotechnology for UCSB Center for Nanoscience in Technology summer interns, 3 – 5 interns per year.

2011 – 2013 Developed one hour interactive presentation on the periodic table of elements, presented at a local elementary school for three consecutive years (grade 5 curriculum).

2010            **Teaching Assistant**, UCSB, Introductory Materials Science, undergraduate, 40 students.

### **Mentored and Co-Supervised Students**

2017 – Present   Andrew Gonzalez (undergraduate, Stanford University)

2016 – Present   Patrick McQuade (graduate, Stanford University)

2016 – 2018     Ella King (undergraduate, Stanford University)

2014 – 2016     Howard Dobbs (graduate, University of California, Santa Barbara)

2015             Aideen Griffin (masters, University of California, Santa Barbara)

2013             Johannes Maurer (masters, University of California, Santa Barbara)

### **Commitment to Diversity and Inclusion**

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Exemplified by involvement in UCSB Graduate Students for Diversity in Science (GSDS); 2010 – 2015.

**GSDS President in 2013 – 2014:** led and managed a **40 member student-run organization with a \$16,500 yearly budget (Dow Endowment)**, hosted 25 Cal State students (PUIs), hosted 3 Diversity Lecturers, expanded impact by organizing GSDS visits to Cal State campuses.

### **Selected Professional Service**

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2017 – 2018     **Elected Member**, Stanford University Postdoctoral Association Council

**Co-Founding Member**, Diversity Advisory Committee

**Co-Founder**, Stanford Diversity Perspectives Seminar Series

2018             **Reviewer for DOE Office of Science Graduate Student Research (SCGSR) Program**

2018             **Session Presider**, *Wetting Adhesion*, 92<sup>nd</sup> ACS Colloids and Surface Science Symposium

2016 – 2018     **Poster Judge**, 90<sup>th</sup>, 91<sup>st</sup>, and 92<sup>nd</sup> ACS Colloids; 2017 and 2018 AIChE National Meeting

2013 – 2018     **Reviewer for the following journals:** *Adv. Mat. Inter.*, *Biomacromolecules*, *J. Phys. Chem. Lett.*, *Langmuir*, *Materials Today*, *Nature*, *Nature Comm.*, *Scientific Reports*, *Soft Matter*

### **Additional Productivity**

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Melosh NA, **Gebbie MA**, McQuade PJ, Gonzalez AE. Method for forming and patterning color centers. *Provisional Patent Application*, Board of Trustees of the Leland Stanford Junior University, November 6, 2018, 62/756360.

King EM, **Gebbie MA**, Melosh NA. The impact of molecular rigidity on diamondoid self-assembly. *arXiv preprint*, arXiv:1810.05695 (2018).