

Nairiti J. Sinha, Ph.D.

Tenure-Track Assistant Professor, Materials Science and Engineering,
Pennsylvania State University, State College, PA USA
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Professional titles

Pennsylvania State University, State College, PA, USA Fall 2023 –
Tenure-track assistant professor, Materials Science and Engineering

Education

University of California, Santa Barbara, Santa Barbara, CA, USA. 2020 – 2023
Postdoctoral Researcher, Material Research Laboratory

University of Delaware, Newark, DE, USA. 2014 – 2020
Ph.D., Materials Science & Engineering

Institute of Chemical Technology (formerly UDCT), Mumbai, India. 2010 – 2014
Bachelor of Technology, Polymer Engineering & Technology

Research experience

Postdoctoral Researcher Oct 2020
Materials Research Laboratory, University of California, Santa Barbara,
Santa Barbara, CA, USA. – June 2023
Advisors: Prof. Matthew E. Helgeson & Prof. Craig J. Hawker

Graduate Research Assistant Jan 2016
Department of Materials Science & Engineering, University of Delaware, Newark, DE, USA. – Aug 2020
Dissertation Advisor: Prof. Darrin J. Pochan
Dissertation title: “Programmable nanomaterials via hybrid assembly of computationally designed coiled coil bundlemers.”

Guest Researcher Feb 2018
NIST Center of Neutron Research (NCNR) , National Institute of Standards & Technology
(NIST), Gaithersburg, MD, USA. – Aug 2020
Advisor: Dr. Grethe V. Jensen, Dr. Paul D. Butler

NIST Researcher Jun 2018
Biomolecular Labeling Lab, Institute for Bioscience & Biotechnology Research, Gaithersburg,
MD, USA. – Aug 2020
Advisor: Prof. Zvi M. Kelman

Graduate Research Assistant Oct 2014
Department of Materials Science & Engineering, University of Delaware, Newark, DE, USA. – Dec 2015
Advisor: Prof. Arthi Jayaraman
Research topic: “Theory and molecular simulations study of polymer-conjugated soft materials for biological applications.”

Teaching experience

- Instructor** Summer 2018
The 24th CHRNS “Summer School on Methods and Applications of Small Angle Neutron Scattering and Neutron Reflectivity”
NIST Center for Neutron Research, NIST, Gaithersburg, MD.
Role: Teach basics of small-angle neutron scattering to 40+ participants; design and guide hands-on experiments on the beamline.
- Graduate Teaching Assistant** Spring 2016
Department of Materials Science and Engineering,
University of Delaware, Newark, USA.
Subject: MSEG302 - Materials Science for Engineers
Instructor: Prof. Michael Mackay
Role: Assist faculty; conduct tutorials; grade examinations.

Internships

- Research Internship** Jul – Aug 2013
Department of Polymer Chemistry and Materials,
National Chemical Laboratory, Pune, India. &
May – Jul 2012
Advisors: Dr. Premnath Venugopalan, Dr. Anuya Nisal, Dr. Ashish Lele
Project title: “Silk Based Biomaterials”
- Summer Internship** May – Jun 2013
Product Application & Research Centre,
Reliance Industries Limited, Mumbai, India.
Advisors: Dr. Nitin V Joshi, Dr. Raju Venkat S.
Project title: “Study of Degradable HDPE films”

Awards & scholarships

- Selected for *Rising Stars in Soft and Biological Matter* symposium 2022 (one of 23 finalists) organized by University of Chicago and UC San Diego MRSEC, Oct 2022.
- Selected for POLY/PMSE Excellence in Graduate Polymer Research Symposium (one of 40 students) and won prize for best submission (one of 2 winners in oral talk category), American Chemical Society, 2020.
- Won 2nd prize for best poster in ‘Biomolecular Self-Assembly for Materials Design’ symposium at the Materials Research Society Fall Meeting, Boston, MA, Nov 2017.
- Won prize for Outstanding performance in Bachelor of Technology batch of 2014 by the Institute of Chemical Technology, Mumbai, India, 2015.
- Awarded the Excellence in Undergraduate Studies prize for undergraduate students by the Narottam Sekhsaria Foundation, Mumbai, India, 2014. (one of three students in Mumbai district)
- Awarded the Merit-Cum-Means Award for Outstanding Undergraduate Student by the Narottam Sekhsaria Foundation, Mumbai, India, 2014. (one of fifty students in Mumbai district)
- Awarded ICT Student’s Fund Prize for 2nd position in third year Bachelor of Technology, Mumbai, India, Mar 2014.

- Awarded Hon' Ratan Tata Trust scholarship for Outstanding performance in undergraduate studies, Mumbai, India, Dec 2013.
- Awarded ICT Student's Fund Prize for 3rd position in second year Bachelor of Technology, Mumbai, India, Mar 2013.
- Awarded the merit-cum-means scholarship by Sandra Saraf Foundation for academic year 2011-2012.
- Awarded ICT Student's Fund Prize for 1st position in first year Bachelor of Technology, Mumbai, India, Mar 2012.
- Awarded Hon' Ratan Tata Trust scholarship for Outstanding performance in undergraduate studies, Mumbai, India, Dec 2011.

Publications

14. Sheth, T.,* **Sinha, N. J.***, Okayama, Y., Hawker, C. J., Helgeson, M. E. Spontaneous De-Mixing of Cosurfactants Stabilize Water-In-Oil Core-Shell Nano-Emulsions. *Submitted *equal contribution*
13. **Sinha, N. J.**, Cunha, K., Murphy, R., Shea, J. E., Hawker, C. J., Helgeson, M. E. (2023). Competition Between Beta-Sheet and Coacervate Domains Yield Diverse Morphologies in Mixtures of Oppositely Charged Homochiral Peptides. *Biomacromolecules, in press.*
-Manuscript selected for *Rising Stars in Soft and Biological Matter symposium 2022*
-Manuscript selected for *ACS Editor's Choice 2023*
12. Garcia, R. V., Murphy, E., **Sinha N. J.**, Okayama, Y., Urueña, J. M., Helgeson M. E., Bates, C., Hawker, C. J., Murphy, R. D., & Read de Alaniz, J. (2023). Tailoring Writability and Performance of Star Block Copolypeptides Hydrogels through Side-Chain Design. *Small*, 2302794. <https://doi.org/10.1002/sml.202302794>
11. Shannon, D. P., Moon, J. D., Barney, C. W., Sinha, N. J., Yang, K. C., Jones, S. D., Garcia, R. V., Helgeson, M. E., Segalman, R. A., Valentine, M. T., & Hawker, C. J. (2023). Modular Synthesis and Patterning of High-Stiffness Networks by Postpolymerization Functionalization with Iron-Catechol Complexes. *Macromolecules*, 56(6), 2268-2276. <https://doi.org/10.1021/acs.macromol.2c02561>
10. Bailey, S. J., Barney, C. W., **Sinha, N. J.**, Pangali, S. V., Hawker, C. J., Helgeson, M. E., Valentine, M. T., & de Alaniz, J. R. (2022). Rational mechanochemical design of Diels-Alder crosslinked biocompatible hydrogels with enhanced properties. *Materials Horizons*. <https://doi.org/10.1039/D2MH00338D>
9. Guo, R., **Sinha, N. J.**, Misra, R., Tang, Y., Langenstein, M., Kim, K., Fagan, J. A., Kloxin, C. J., Jensen, G. V., Pochan, D. J., & Saven, J. G. (2022). Computational Design of Homotetrameric Peptide Bundle Variants Spanning a Wide Range of Charge States. *Biomacromolecules*, 23(4), 1652-1661. <https://doi.org/10.1021/acs.biomac.1c01539>
8. Villegas, J. A.*, **Sinha, N. J.***, Teramoto, N., Von Bargen, C. D., Pochan, D. J., & Saven, J. G. (2022). Computational Design of Single-Peptide Nanocages with Nanoparticle Templating. *Molecules*, 27(4), 1237. <https://doi.org/10.3390/molecules27041237>
* equal contribution
7. **Sinha, N. J.**, Guo, R., Misra, R., Fagan, J., Faraone, A., Kloxin, C. J., Saven, J., Jensen, G., & Pochan, D. J. (2022). Colloid-like solution behavior of computationally designed coiled coil bundlers. *Journal of Colloid and Interface Science*, 606, 1974-1982. <https://doi.org/10.1016/j.jcis.2021.09.184>
-Selected for *Highlights in NCNR Accomplishments and Opportunities report 2022*
6. **Sinha, N. J.**, Langenstein, M. G., Pochan, D. J., Kloxin, C. J., & Saven, J. G. (2021). Peptide Design and Self-assembly into Targeted Nanostructure and Functional Materials. *Chemical Reviews*, 121(22), 13915-13935. <https://doi.org/10.1021/acs.chemrev.1c00712>
5. **Sinha, N. J.**, Shi, Y., Tang, Y., Kloxin, C. J., Saven, J. G., Faraone, A., Jensen, G., & Pochan, D. J. (2021). Intramolecular structure and dynamics in computationally designed peptide-based polymers displaying

tunable chain stiffness. *Physical Review Materials*, 5(9), 095601.

<https://doi.org/10.1103/PhysRevMaterials.5.095601>

-Selected for Highlights in NCNR Accomplishments and Opportunities report 2022

4. **Sinha, N. J.**, Kloxin, C., Saven, J., Jensen, G., Kelman, Z., Pochan, D. (2021) Recombinant expression of computationally designed peptide-bundlers in *Escherichia coli*, *Journal of Biotechnology* 330, 57-60. <https://doi.org/10.1016/j.jbiotec.2021.03.004>
3. **Sinha, N. J.**, Wu, D., Saven, J., Kloxin, C., Jensen, G., Pochan D. (2019) Polyelectrolyte character of rigid rod peptide bundlemer chains constructed via hierarchical self-assembly, *Soft Matter* 15 (48), 9858-9870. <https://doi.org/10.1039/C9SM01894H>
-Highlighted in NCNR Accomplishments and Opportunities report 2020
<https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1257.pdf>
2. Wu, D., **Sinha, N. J.**, Lee, J-Y., Zhang, H., Saven, J., Kloxin, C., Pochan D. (2019) Polymers with Controlled Assembly and Rigidity Made with Click-functional Peptide Bundles, *Nature* 574 (7780), 658-662. <https://doi.org/10.1038/s41586-019-1683-4>
-Highlighted in NCNR Accomplishments and Opportunities report 2020
<https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1257.pdf>
- Highlighted in UDaily news
<https://www.udel.edu/udaily/2019/october/bundlemers-darrin-pochan-chris-kloxin-new-polymer-term-coined/>
- Highlighted in ScienceDaily news
<https://www.sciencedaily.com/releases/2019/10/191030155834.htm>
1. Haider, M., Zhang, H., **Sinha, N. J.**, Saven, J., Kiick, K., Pochan, D. (2018) Self-assembly and soluble aggregate behavior of computationally designed coiled coil peptide bundles, *Soft Matter* 14 (26), 5488-5496. <https://doi.org/10.1039/C8SM00435H>

Patents

1. Nisal, A., Venugopalan, P., **Sinha, N.** (2014) Silk based porous scaffold and a process for the preparation thereof. Patent WO Appl. 2014125505A1. <https://patents.google.com/patent/WO2014125505A1/en>
-Culminated in commercial product: <https://serigenmed.com/serioss/>

Invited talks at seminars and conferences

- **Sinha, N.** Computationally-Informed Peptides as Modular Building Blocks for Supramolecular Self-Assembly. *Invited seminar talk as incoming assistant professor at Pennsylvania State University, University of California at Los Angeles, Los Angeles, CA, June 2023.*
- **Sinha, N.** Computationally-Informed Peptides as Modular Building Blocks for Supramolecular Self-Assembly. *Invited seminar talk, North Carolina State University, Raleigh, NC, Feb 2023.*
- **Sinha, N.**, Hawker, C., Helgeson, M. Competition of Folding-Induced Assembly and Liquid-Liquid Phase Separation Produces Diverse Morphologies of Homochiral Peptide Mixtures. *Invited symposium talk, MRSEC Rising Stars in Soft and Biological Matter Symposium, University of Chicago, Illinois, October 2022.*
- **Sinha, N.** Supramolecular self-assembly of computationally designed coiled coil building blocks. *Invited conference talk, American Conference on Neutron Scattering, Boulder, CO, June 2022.*
- **Sinha, N.** Computationally designed coiled coil bundlemers as building blocks for supramolecular self-assembly. *Invited conference talk, Joint Nanoscience and Neutron Scattering User Meeting, Aug 2021.*
- **Sinha, N.** The structure and dynamics of supramolecular coiled coil bundlemer assemblies. *Invited talk for the National Academies of Sciences, Engineering & Medicine's Panel on assessment of the NIST Center for Neutron Research, Gaithersburg, MD, July 2021.*

- **Sinha, N.** Design and assembly of model coiled coil forming peptides. *Invited seminar talk*, IBBR Seminar Series, Institute for Bioscience & Biotechnology Research, Gaithersburg, MD, May 2020.
- **Sinha, N.** Computationally designed coiled coil bundlers as modular building blocks for supramolecular self-assembly. *Invited seminar talk*, Soft and Living Matter Seminar Series, University of California Santa Barbara, Santa Barbara, CA, Mar 2020.
- **Sinha, N.**, Kloxin, C., Saven, J., Pochan, D. Exotic polymers of computationally designed bundlers constructed via a new hybrid physical- covalent assembly pathway. *Award Oral talk*, POLY/PMSE Excellence in Graduate Research Symposium, American Chemical Society, Spring National Meeting, Philadelphia, PA, Mar 2020.
- **Sinha, N.** Characterization of computationally designed coiled coils and their hierarchical assemblies using small angle scattering techniques. *Invited seminar talk*, Low-Q Seminar Series, NIST Center for Neutron Research, Gaithersburg, MD, Dec 2018.

Mentorship and leadership activities

- Elected member of the executive committee, NIST Center for Neutron Research (NCNR) User Group (NUG), Gaithersburg, MD (2021-present).
- Actively mentored chemical engineering undergraduate student Zachary Sheffield in Pochan group, University of Delaware (2016-2017). Zachary is currently a Ph.D. student at the University of Maryland Baltimore County.

Proposal writing experience

- Two independent NSF BioPACIFIC MIP proposals accepted between 2021-2022.
 - *Current proposal highlighted on website:* <https://biopacificmip.org/research/user-projects/bpl001>
- Multiple beamtime proposals (2) and access requests (2) awarded between 2020-2022 at the High-flux Isotope Reactor (HFIR), Oak-Ridge National Laboratory, Knoxville, TN.
- Multiple beamtime proposals (5) and access requests (>5) awarded between 2017-2022 at the NIST Center for Neutron Research (NCNR), NIST, Gaithersburg, MD.
- One general user research proposal awarded in 2018-2020 for performing small-angle X-ray scattering experiments at Advanced Photon Source, Argonne National Laboratory, Chicago, IL.

Conference presentations

- **Sinha, N.**, Hawker, C., Helgeson, M. Competition of Folding-Induced Assembly and Liquid-Liquid Phase Separation Produces Diverse Morphologies of Homochiral Peptide Mixtures. *Oral presentation*, AIChE Annual Meeting, Phoenix, AZ, Nov 022. (#27a in *Biomaterials and Life Sciences Engineering: Faculty Candidates I*)
- **Sinha, N.** Theory and Design of Non-Natural Peptides That Undergo Folding-Induced Self-Assembly to Liquid-Liquid Phase Separation. *Poster presentation*, AIChE Annual Meeting, Phoenix, AZ, Nov 022. (#2 in *Meet the Faculty Candidates Poster Session*)
- **Sinha, N.**, Hawker, C., Helgeson, M. Diverse morphologies of mixtures of opposite charged homochiral peptides. *Oral presentation*, ACS Colloids Meeting, Colorado School of Mines, Golden, CO, Jul 2022.
- **Sinha, N.**, Garcia, R., Sheth, T., Helgeson, M., Hawker, C., Designing modular biomaterials using non-canonical peptide substituents on a benzene-1,3,5-tricarboxamide core. *Oral presentation*, American Chemical Society, Spring National Meeting, San Diego, CA, Mar 2022.
- **Sinha, N.**, Hawker, C., Helgeson, M. Competition of folding-induced assembly and liquid-liquid phase separation produces diverse morphologies of peptide coacervates. *Oral presentation*, American Physical

Society, March Meeting, Chicago, IL, Mar 2022.

- **Sinha, N.**, Shi, Y., Jensen, G., Pochan, D. Structure and dynamics of polymeric hybrid physical-covalent assemblies of computationally designed peptidic bundlers. *Oral presentation*, American Physical Society, March Meeting, Mar 2021. (*virtual*)
- **Sinha, N.**, Jensen, G., Pochan, D. Exotic Hybrid Polymers of Computationally Designed Coiled Coil Bundlers—A Structure and Dynamics Study Using Neutrons. *Oral presentation*, American Conference on Neutron Scattering, July 2020. (*virtual*)
- **Sinha, N.**, Misra, R., Guo, R., Kloxin, C., Saven, J., Pochan, D. Computationally designed coiled coil peptides as model charge-patterned colloidal particles. *Oral Presentation*, American Chemical Society, Spring National Meeting, Philadelphia, PA, Mar 2020.
- **Sinha, N.**, Kloxin, C., Saven, J., Pochan, D. Computationally designed bundlers for hybrid physical-covalent assembly of rigid polymers. *Oral Presentation*, American Physical Society, March Meeting, Denver, CO, Mar 2020.
- **Sinha, N.**, Misra, R., Guo, R., Kloxin, C., Saven, J., Jensen, G., Pochan, D. Tuning Interactions between Modular Coiled Coil Bundles via Computational Sequence Design—A Small Angle Neutron Scattering (SANS) Study. *Oral Presentation*, Materials Research Society, Fall Meeting, Boston, MA, Nov 2019.
- **Sinha, N.**, Wu, D., Kloxin, C., Saven, J., Jensen, G., Pochan, D. Tuning interactions between hybrid physical-covalent rigid rods made of computationally designed coiled coils by peptide sequence manipulation. *Oral Presentation*, American Physical Society, March Meeting, Boston, MA, Mar 2019.
- **Sinha, N.**, Misra, R., Guo, R., Kloxin, C., Saven, J., Jensen, G., Pochan, D. Tunable construction of 1D nanomaterials using computationally designed coiled coil peptides. *Poster Presentation*, 26th Annual NIST Chapter of Sigma Xi Postdoctoral Poster Presentation (PPP), National Institute of Standards and Technology (NIST), Gaithersburg, MD, Mar 2019.
- **Sinha, N.**, Wu, D., Kloxin, C., Saven, J., Jensen, G., Pochan, D. Rigid rod vs semiflexible chain construction through connection of computationally designed coiled coil peptides using Thiol-Michael click reaction. *Oral Presentation*, American Chemical Society, Spring Meeting, Orlando, FL, Mar 2019.
- **Sinha, N.**, Wu, D., Kloxin, C., Saven, J., Jensen, G., Pochan, D. Hierarchical Assembly of Computationally Designed Coiled Coils into Tunable 1D Architectures. *Oral Presentation*, Materials Research Society, Fall Meeting, Boston, MA, Nov 2018.
- **Sinha, N.**, Wu, D., Kloxin, C., Saven, J., Pochan, D., Jensen, G. Hybrid 1D assembly of model coiled coils and characterization using small angle scattering. *Oral Presentation*, XVII International Small Angle Scattering Conference (SAS 2018), Traverse City, MI, USA, Oct 2018.
- **Sinha, N.**, Wu, D., Kloxin, C., Saven, J., Jensen, G., Pochan, D. Small Angle Neutron Scattering Study of Computationally Designed Coiled Coil Peptides and Their Higher Order 1D Assemblies, *Oral Presentation*, American Conference on Neutron Scattering, College Park, MD, May 2018.
- **Sinha, N.**, Wu, D., Kloxin, C., Saven, J., Pochan, D. Tunable 1D supramolecular architectures constructed via solution and chemical assembly of model coiled coil peptides. *Oral Presentation*, American Physical Society, March Meeting, Los Angeles, CA, Mar 2018.
- **Sinha, N.**, Wu, D., Lee J., Zhang H., Kloxin C., Saven J., Pochan D. Self-Assembly of Computationally Designed Nano-Cages Based on the Coiled Coil Bundle Motif. *Poster presentation*, Materials Research Society Fall Meeting, Boston, MA, Nov 2017. (*2nd prize*)
- **Sinha, N.**, Villegas, J., Kiick, K., Saven, J., Pochan, D. Self-assembled nano-cages based on the coiled coil bundle motif. *Poster*, American Physical Society March Meeting, New Orleans, LA, Mar 2017.

Professional development and service

- Invited by editor to review papers for Journal of Polymer Science, Part A and RSC Materials Advances. 2021-present

- Session chair at the American Conference on Neutron Scattering, Boulder, CO Jun 2022
- Session chair at the American Chemical Society, Spring National meeting, San Diego, CA. Mar 2022
- Symposium Assistant, Materials Research Society Fall Meeting, Boston, MA. Nov 2017
- Member of American Chemical Society, American Physical Society & Materials Research Society. 2016-present
- Participant, workshop on "SASSIE-web Atomistic Modeling of SAXS Data", Advanced Photon Source, Chicago, Illinois Sept 2016
- Inaugural Member of organizing committee, Graduate student & Postdoc seminar series sponsored by NIH-COBRE Center for "Molecular Design of Advanced Biomaterials", University of Delaware, Newark, DE. 2015-2016
- Participant, 3-day seminar on "Rheology of Paints and Emulsions", Venture Center, Pune, India Dec 2012

Outreach activities

- Elected Publicist, Professional Women's Association, UC Santa Barbara, Santa Barbara, CA. 2021-2022
- Elected Publicist & Representative, Women in Engineering (WIE), University of Delaware, Newark, DE. 2015-2017
- Volunteer, ASM Teachers Material Camp, Brandywine Valley, Chapter, DE. July 2016