Thomas Joseph Barrett

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RESEARCH INTERESTS

Multiscale modeling of semicrystalline polymer nanocomposites for high performance materials.
Sustainable polymer production and fiber development.
Microplastic pollution and nanotoxicity.
Polymer discovery through Machine Learning.
Inverse design of polymeric systems and composites.

EDUCATION

Ph.D. Mechanical Engineering (Materials Science) — Boston, MA | Expected Summer 2023
Northeastern University
Advisor: Dr. Marilyn L. Minus
Dissertation Topic: Multiscale modeling of semicrystalline polymer nanocomposites

MSc. Mechanical Engineering (Mechanics and Design) — Boston, MA | 2018
Northeastern University
Thesis: Effects of solar radiation and surface roughness on nominally flat coastal rocks

BSc. Mechanical Engineering — Rochester, NY | 2016
University of Rochester

ACADEMIC CONTRIBUTIONS

PUBLICATIONS

Barrett T. J. & Minus M. L. Thermostat, barostat, and damping parameter impact on tensile behavior of graphene. Submitted.
Barrett T. J., Li M., Gouhier T., Rilov G., Helmuth B., & Müftü S. Effects of solar radiation and surface roughness on surface temperatures of coastal rocks. Awaiting Submission.

CONFERENCE CONTRIBUTIONS

Barrett, T. J. & Minus, M. L. A cluster-based approach for identifying and meshing crystalline regions in molecular dynamics simulations. Oral Presentation. Materials Research Society (MRS) Spring Meeting 2022. Honolulu, Hawaii (USA), May 2022.

PROJECTS

MULTISCALE MODELING OF POLYMER NANOCOMPOSITES — Python, LAMMPS, Abaqus

Combined experimental, molecular dynamics, and finite element approach to describing semicrystalline polymer nanocomposite behavior.
Developed methods to determine crystalline regions within molecular dynamic polymer melts to maintain semicrystalline behavior across domains.
Semicrystalline polymer film and fiber fabrication and characterization, primarily focused on Polyvinyl Alcohol and Polyacrylonitrile.

3D PRINTING OF HEC - ALGAE BIOCOMPOSITES — Python, LAMMPS

Collaboration with **Daraio Laboratory at California Institute of Technology** and **MaP+S Group at Harvard University**.
Performed mesoscale dissipative particle dynamics (DPD) simulations to determine reinforcement mechanisms of 3D printed cellulose biocomposites.

PYFIBER — Python, PyQT

An open-source tool for visualization and analysis of Wide Angle X-Ray Diffraction (WAXD) results using a nodal approach.

SURFACE ROUGHNESS & THERMAL REFUGIA

COMSOL, MATLAB

International, multi-disciplinary collaboration between **Northeastern University's Mechanical and Industrial Engineering** and **Marine and Environmental Sciences** departments and the **Israeli National Institute of Oceanography, Oceanographic and Limnological Research**.

3D GIS scans of coastal surfaces with 1 cm^2 resolution were converted to $\sim$1 m^3 meshes to determine the relationship between surface roughness and area of thermal refugia for sessile organisms under solar radiation.

TEACHING

TEACHING ASSISTANT

ENLR 5121, 5122: Gordon Engineering Leadership Program
MATL 6285: Structure, Properties, and Processing of Polymeric Materials

VOLUNTEER

COLLEGE OF ENGINEERING PH.D. COUNCIL

Managed and organized events including weekly coffee hours and monthly seminar series.
Helped college distribute surveys and solicit feedback from Ph.D. students.

MECHANICAL AND INDUSTRIAL ENGINEERING GRADUATE COUNCIL

Helping guide formation and applications towards becoming an independent student group.

SKILLS

Programming Languages: Python, MATLAB
Technology: Git, LaTeX, PyQT, SKLearn, COMSOL, LAMMPS, Abaqus
Fabrication: Neat polymer films and fibers. Polymer- Carbon Nanotube (CNT) composite films and fibers. Dry-wet (Gel) spinning.
Characterization Equipment: TGA, DSC, DMA, Optical Microscopes, WAXD, SAXS, SEM