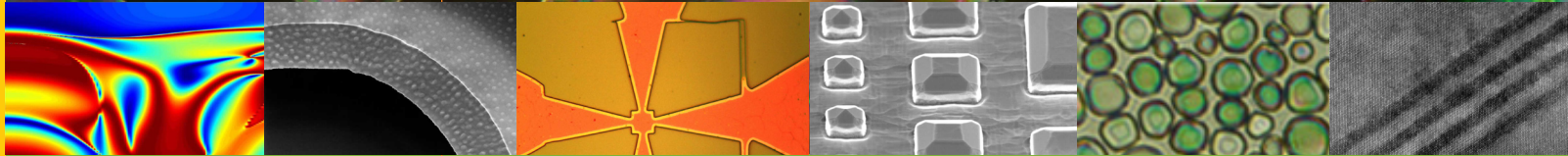




# Synthesizing, characterizing and understanding complex interfaces for development of new materials systems for advanced electronics and photonics through to biology



The Wisconsin MRSEC brings together researchers from University of Wisconsin and six partner institutions in the northeast of the US to tackle key challenges involving the design of complex interfaces in hard and soft materials that can only be addressed through multidisciplinary approaches.

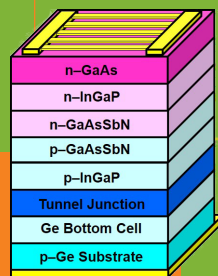
One interdisciplinary group of the Wisconsin MRSEC is addressing the challenge of designing complex multicomponent semiconductors that are thermodynamically unstable. The work centers on bismide semiconductors and InGaAsSbN materials, and is distinguished by the use of theory and experiment to elucidate non-equilibrium strategies for control of nanostructure and properties.

A second interdisciplinary group strives to understand electron transfer at interfaces and to exploit this understanding in applications ranging from optoelectronics to photochemistry. The team is unique in possessing characterization tools that permit elucidation of dynamic molecular and electronic processes that occur over a remarkably wide range of temporal scales.

A third interdisciplinary group seeks to understand the role of liquid crystallinity in biological materials that perform complex functions, and to leverage that understanding to design new classes of synthetic liquid crystal-based materials that are capable of carrying out functions not previously demonstrated. This work emphasizes biological inspiration and the interplay of mechanical stresses, defects and complex interfaces.

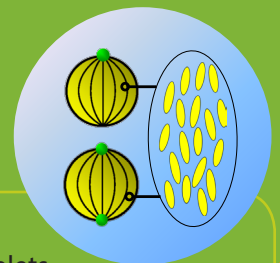
The Wisconsin MRSEC is also home to a cross-cutting interdisciplinary team of computational scientists. The goal of this team is to facilitate synergies related to computation across the Center.

Wisconsin MRSEC



## HIGHLIGHTS ...

New metastable materials enable devices such as advanced multi-junction solar cells.

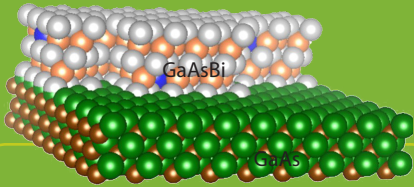
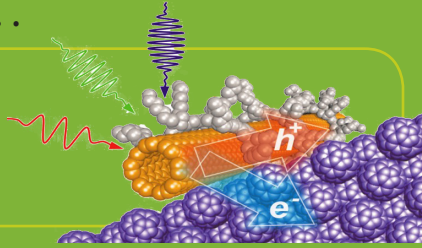


Colloid-liquid crystal (LC) droplets make possible the formation of organized, reconfigurable patchy particles.

DIRECTOR: Nicholas L. Abbott  
[www.mrsec.wisc.edu](http://www.mrsec.wisc.edu)

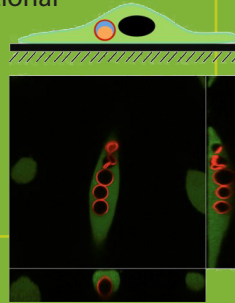
## RESEARCH FUNDAMENTALS...

Multidimensional optical spectroscopy is being used to understand mechanisms that lead to exciton migration in carbon-nanotube composite materials.



The MRSEC is addressing the challenge of designing, synthesizing and characterizing novel multinary semiconductor materials that are thermodynamically unstable, and developing non-equilibrium strategies to produce them in forms with low defect density.

Liquid crystals (LC) are being "caged" within polymeric membranes so as to trigger simultaneous changes in both LC domain shape (e.g., spheres to hemispheres) and internal orientational ordering, thus providing the basis of new classes of responsive soft matter.



I am struck by the unanticipated solutions to complex materials problems that arise within the MRSEC from the interactions of faculty and students from diverse disciplinary backgrounds. //

Nicholas L. Abbott, Director  
UW MRSEC



## WISCONSIN MRSEC EDUCATION OUTREACH AND PARTNERSHIPS...

- Research Experience for Undergraduates: undergraduates conduct summer research in a materials-related area of engineering, physics, chemistry, science education, or public policy.
- Institute for Chemical Education: partner for creation and dissemination of materials science kits for K-12 classrooms and museums.
- Research Experience for Teachers: middle and high school teachers from Puerto Rico and Wisconsin develop learning modules based on their laboratory research.
- Partnership for Research and Education in Materials with the University of Puerto Rico-Mayaguez: partner in pursuing collaborative research and educational outreach.
- Wisconsin Advanced Materials Industrial Consortium: partner in university-industry collaboration in advanced materials and manufacturing fields.
- Materials Research Facilities Network: partner in expanding the use of the Shared Experimental Facilities.

# OUTREACH

More information about the workshops, internships, partnerships, and educational opportunities are available at [www.mrsec.wisc.edu](http://www.mrsec.wisc.edu)

