Materials Science & Engineering Seminar Series

Carnegie Mellon University
Materials Science & Engineering

presents

Directed-Assembly Routes to Photonic Mesophases

Chekesha M. Watson
Associate Professor, Materials Science and Engineering, Cornell University

ABSTRACT:
Photonic crystals (PCs) dramatically alter the dispersion relations and the spatial power distribution of electromagnetic modes in dielectric materials with a periodic refractive index. Specific designs of photonic crystals promote photonic bandgaps, i.e., frequency ranges over which propagation is disallowed in the material for all directions and polarizations of light. The anomalous dispersion in PCs enables light localization, spontaneous emission suppression, slow light, and effective negative refraction. Such PC properties have been applied in sensors, waveguides, solid state lighting, photovoltaics, superlenses, etc. However, it is challenging to fabricate photonically active materials using the self-assembly of spheres because of the degeneracy in the photonic bands at points of high symmetry. Anisotropic particles with hard body and dipolar interactions provide structural diversity (i.e., a wide range of structures including crystals, mesophases, and semi-regular tilings), and align with the symmetry-reduction strategy that promotes bandgaps. Moreover, properties that depend on the bands themselves and their dispersion, such as refraction and slow light, have not been addressed in self-assembled systems. The present talk will focus on the self-organization of anisotropic particles into photonic solids and their optical band gap, all-angle negative refraction (AANR), and slow light properties.

BIOGRAPHY:
Chekesha Watson received a Bachelor of Science in Chemistry with Highest Distinction from Spelman College (1999) and a Bachelor of Materials Engineering from Georgia Institute of Technology (1999). She was awarded the NASA Women in Science and Engineering Scholarship to support her undergraduate work and held three internship appointments at NASA, Kennedy Space Center in the Cryogenics and External Tank Branch and the Microchemical Analysis Laboratories. She joined the Cornell University faculty in November of 2003, after receiving a Ph.D. in Materials Science and Engineering with a minor in Science and Technology Policy from Georgia Tech. Watson's awards for scholarly achievement include the National Science Foundation (NSF) Presidential Early Career Award for Scientists and Engineers (PECASE), (2007); NSF Career Award, (2006); Facilitating Academic Careers in Engineering and Sciences Career Initiation Grant, (2003); Office of Naval Research Graduate Fellowship, (1999-2003); Georgia Tech President's Fellowship, (1999-2003); Facilitating Academic Careers in Engineering and Sciences Fellowship, (1999-2003); National Society of Black Engineers Fellow, (2000); Hertz Foundation Fellowship Grant, (1999); TMS materials society, J. Keith Brimacombe Presidential Scholarship, (1999); ASM Foundation Scholarship, ASM International materials society, (1998); and the ASTM, American Society for Testing and Materials, Mary R. Norton Memorial Fellowship, (1999).

Doherty Hall 2210, 11:30AM
Friday, April 19, 2019