

Seminar



Magnetic Nanowires: Revolutionizing Hard Drives, RAM, and Cancer Treatment

Bethanie Stadler

July 22, 2015 | 3:30 - 4:30 PM | HH 1107

Seminar abstract

Magnetic nanowires can have many names: bits, sensors, heads, artificial cilia, sensors, and nano-bots. These applications require nanometer control of dimensions, while incorporating various metals and alloys. To realize this control, 7- to 200-nm diameter nanowires are synthesized within insulating matrices by direct electrochemistry. Our nanowires can easily have lengths 10,000x the diameters, and they are often layered with magnetic and non-magnetic metals as required by each application. This talk will reveal synthesis secrets for nm-control of layer thicknesses, even for different alloys, which has enabled studies of magnetization reversal, magneto-elasticity, giant magnetoresistance, and spin transfer torque switching. These nanowires will mitigate the ITRS Roadmap's "Size Effect" Grand Challenge which identifies the high resistivities in small interconnects as a barrier to continued progress along Moore's Law (or better). High magnetoresistance is also possible in other multilayered nanowires that exhibit excellent properties for multi-level nonvolatile random access memory. If the insulating growth matrix is etched away, the nanowires resemble a magnetic bed of nano-seaweed which enables microfluidic flow sensors and vibration sensors. Finally, we have incubated various nanowires with several healthy and cancerous cell lines, and find that they are readily internalized. Careful magnetic design of these "nano-bots" enables external steering, nano-barcode identification, and several modes of therapy.



This seminar is co-sponsored by the IEEE Magnetics Society and the DSN-I.

The DSN-I Seminar Series is hosted by the Device Science and Nanofabrication Initiative. DSN-I Seminars target researchers in micro and nanofabrication technologies or devices, with the goal of strengthening the user community of the new Scott Hall nanofabrication facility and other shared infrastructure.

Speaker bio

Bethanie Stadler works on the integration of magnetic nanowires for magnetoelectronic (including hard drive heads), microfluidic flow sensors and actuators, acoustic/vibration sensor applications, and cellular biomarkers. In photonics, Stadler works on the integration of magnets, magneto-optical garnets waveguides, and nanostructures for magnetophotonic crystals with semiconductor platforms for isolator and sensor applications. Stadler received her PhD from MIT in 1994 and her B.S. from Case Western Reserve University in 1990. She held a National Research Council postdoctoral fellowship at the Air Force Rome Laboratory before joining Electrical and Computer Engineering at the University of Minnesota. Her research there has been awarded the NSF CAREER award and a McKnight Presidential Fellowship. Stadler has served as Director and Secretary of the international Materials Research Society.

Seminar notes: Light snack and beverages will be served.