

## **Magnetic Liquids for Lab-on-a-Chip and Rapid Diagnostics Applications**

**Hür Köşer**

**Assistant Professor of Electrical Engineering, Yale University**

**Monday, September 25, 2006**

**2:00 PM in the Birck Building, Room 2001**

Ferrofluids are stable colloidal suspensions of nanosize ferromagnetic particles in either aqueous or oil-based media. They have found their way into a variety of applications, such as sealing, damping and blood separation; in dilute, functionalized forms, they have also been used as drug delivery and MRI contrast agents. These complex liquids offer attractive alternatives to moving mechanical components in miniaturized cooling, pumping and integrated micro-total-analysis-systems for chip-scale chemistry and biology. Water-based ferrofluids can also be made bio-compatible, rendering them useful in novel cell manipulation and sorting schemes. We have recently proposed, modeled and experimentally confirmed that ferrofluids can be actuated and pumped in closed-loop geometries, even within geometries of micro-scale devices. The pumping dynamics depend on the average nanoparticle size within the ferrofluid. If particles are functionalized with a receptor molecule, the entire volume of the ferrofluid becomes a pathogen sensor that can detect minute quantities of target antigens efficiently and effectively. We are working on creating portable, disposable, cheap and miniaturized sensor and diagnostic devices based on this dynamic effect. We also briefly report on the development of a novel, ferrofluid-based assay to study a large quantity of ligand-receptor interactions quickly and simultaneously, without the need for any wash cycles.



Dr. Koser obtained double B.S. degrees in Electrical Engineering and Physics from the Massachusetts Institute of Technology (MIT), a Master's of Engineering degree for his work on magnetic random access memory devices at IBM T. J. Watson Research Laboratory. He stayed at MIT's Electrical Engineering Department to get a Ph.D. in the field of Microsystems (2002). After a post doctoral work in microfluidics at the Research Laboratory of Electronics at MIT, he joined the Electrical Engineering Department at Yale University as an Assistant Professor in 2003, where he currently conducts research in micro and nanotechnology applications to biomedical engineering and power devices. Dr. Koser has recently received the NSF Career Award for his work on ferrofluid dynamics and will be on a prestigious Junior Faculty Fellowship (awarded by Yale University) during the next academic year to expand his work on ferrofluids. He is also the recipient of the 2003 Yale Information Technology Systems (ITS) Instructional Innovation Award and the Moore Award for the development of a microfluidics-based teaching laboratory.

**Host: Cagri Savran, Mechanical Engineering Department, (48601, savran@purdue.edu)**