MAR10-2009-008454

Abstract for an Invited Paper
for the MAR10 Meeting of
the American Physical Society

Magnetoresistive Sensors in Biological Assays

MARK TONDRA, Diagnostic Biosensors, LLC

Magnetic beads or nanoparticles can be used as "labels" in biochemical assays by attaching the beads to the biospecies of interest using a bio-specific attachment. Once the labels are attached, they can be used to manipulate, capture, and detect the species to be analyzed. Magnetoresistive (MR) sensors may be used to detect and count these labels, and thus make an inference about the concentration of the species of interest. MR technology is especially promising for biosensor applications where making the detector small and integrated with related sample handling tools to form a "lab-on-a-chip" miniaturized system. The function of the MR sensors is to detect stray magnetic fields from the beads while they are exposed to a magnetic excitation field. Generally, the stray fields from beads and clusters of beads are complicated functions of geometry, so some care is required to relate the detected magnetic signal to the number and location of the bead labels. This presentation will begin with a broad overview of results from many groups working in this area. For convenience, the applications are divided into three categories, detection of: flowing magnetic beads, immobilized beads, and scanned samples. Next will be some discussion of how the choice of spintronic sensor technology might affect detection capabilities (AMR, GMR, TMR, Hall effect, etc). Then, challenges relating to integration of MR sensors into microfluidic products will be discussed. This is the focus of the presenter's current day-to-day work on developing and producing MR-based biosensors. And finally, a description of possible future avenues of study and development will be presented.