Workshop VI

Magnetic beads, magnetoresistive sensors and DNA chips

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Magnetoresistive biochips manipulate and detect magnetically labelled biomolecular species in their interactions with immobilized biomolecular species. Different sensor architectures are reviewed (spin valves, GMR multilayers, planar Hall, magnetic tunnel junctions, AMR rings) and compared using as figure of merit the minimum detectable magnetic label size, for excitation fields of the order of 1kA/m, and using magnetite labels as reference. Sensors with few micron square active areas can detect down to single 130 nm beads or even smaller magnetite particles, depending on their FeOx weight content. Increasing magnetizing fields, particle susceptibility, and measuring frequency, and/or scaling the sensor dimensions to particles sizes, will easily bring single 10 nm label detection within detection range. Use of nm sized labels (10 to 50nm) will require detection capabilities of few nT for sensors of micron size areas. Experimental data on cystic fibrosis gene mutation detection using a spin-valve based DNA biochip is shown. This detection platform has the capability of operating with reduced target concentrations (down to single biomolecule manipulation and detection) by using on-chip generated field traps and guide lines, together with MR sensor arrays.