

Comparison between Finite Element Method and Micromagnetics for Integrate Magnetic Concentrator

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Recently, the magnetic sensor is widely applied to the automobile and many electrical devices. And the markets have required low power consumption, high detectivity, linearity, three-dimensional measurement ability, small package size and low cost. For these requirements, we employed the Integrate Magnetic Concentrator(IMC) and the Giant Magnetoresistance(GMR) sensor. Moreover, the micromagnetic simulations are essential tools in the field of the magnetic research. Before we carried out an experimental procedure, we performed simulations for IMC and GMR. We used two kinds of the numerical simulation: one is the Finite Element Method(FEM) and the other is the Mumax3. We employed the magnetic parameters as Py for IMC and GMR thin film and also the various shapes of IMC and GMR sensor the same as the actual size. We obtained result respectively for FEM and Mumax3 and realized that both results are quite different, which will be described and discussed on this paper.

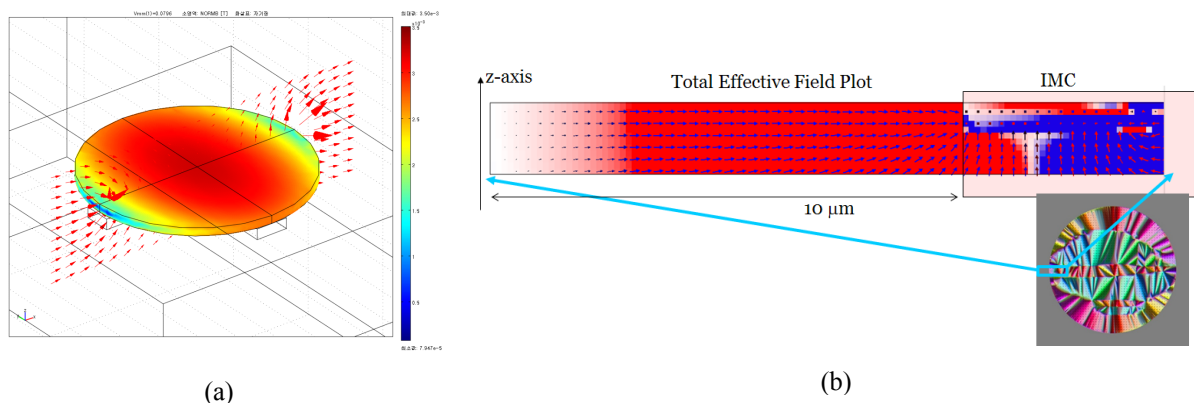


Fig. 1. (a) Magnetic field distribution around an IMC. This figure shows the magnetic field distribution around an disk shaped IMC as an example of FEMsimulation results. Since there is no way to express magnetic domains in FEM simulation, the magnetic material of the disk was supposed to be homogeneous. (b) Micromagnetics simulation result of IMC by Mumax3 indicated multi-domain structures at small field region.