Fabrication and Magnetic Properties of Graded Magnetocrystalline Anisotropy Nano-dots

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Exchange-coupled composites (ECC) and gradient media allows a lower write field for a given thermal stability relative to conventional media and is proposed to solve the writing problem of high K_u recording media such as $L1_0$ FePt alloy thin films. The challenge to implement this concept is to deposit compositional gradient thin films whose easy magnetization axis align out-of-plane and to fabricate the thin films into magnetically isolated nano-dots. Though several simulations have predicted that a combination of the thermal stability and lower switching field advantages are to be gained by ECC and gradient media, there are relatively few experimental works to implement the ECC and graded media concepts. In this work, (001) oriented $L1_0$ Fe-Ni-Pt thin films were deposited onto (001) MgO substrates and patterned into nano-dots by electron beam lithography and Ar ion etching. The magnetic properties of the patterned single compositional, multilayer, and continuous gradient sample were measured and the Victora figure of merit was estimated. It was found that gradient media can effectively reduce the switching field without loss of thermal stability.