Magnetic properties of ion beam induced ripple pattered Fe layers

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Abstract

There is a rapidly growing interest in nanopattered ferromagnetic films. Apart from fundamental investigations, one motivation is the search for materials which are ferromagnetic even at nanometer scales. It has been found that ion beam induced ripples of epitaxially grown Co induce a strong uniaxial magnetic anisotropy[1]. Comparable experiments with epitaxial Fe films on MgO[2] and polycrystalline Fe films on Si[3], both textured by ion beam erosion, showed similar magnetic properties. This study is about nanopattered thin epitaxial Fe layers grown on MgO by PLD. Pattering was done by grazing incidence sputter erosion using 5 keV Ar ions. Additional cosputtering of Fe was used to attenuate the effective sputter yield and to achieve a thickness gradient. Alternatively, pure MgO was irradiated with the same parameters using an Fe cosputtering target to achieve a very thin steady state Fe coverage on nanostructured MgO. We investigate the magnetic and structual properties of the nanopattered Fe layers as a function of the residual film thickness using MOKE, RBS and AFM. Both side polished MgO substrates were used to perform MOKE measurements of the Fe / MgO interface to determine the influence of the ion beam induced surface ripple patterns on the magnetic properties of the unirradiated underlying layer.

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