The magnetization reversal of Fe films on Ag pyramidal islands

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In this study, we manipulated the surface roughness and island shape of Ag films on Si(100) substrates and studied the magnetization reversal of Fe films on the Ag surface. For example, for the deposition temperature>300°C, well-defined Ag(100) submicrometer pyramidal islands with truncated top were obtained. Moreover, the grain edges of Ag island is parallel to Si{011} in-plane directions and the sidewalls of these Ag islands are just {111} planes [1], as shown in Fig. (a).

A 50nm thick Fe film was then deposited on Ag islands at 100°C to reduce the interdiffusion between Fe and Ag. Therefore, the morphology of Fe layer followed the island shape of Ag submicrometer pyramids. By applying an in-plane field, the MFM observed strip-like domains at the saturated state. After reversing the field, the magnetic domains were first nucleated at the sidewalls of pyramidal islands with its magnetization perpendicular to the film plane. These perpendicular magnetic domains were then joined together to form 180°-like magnetic domain walls, as shown in Fig. (b). The domain walls propagated as increasing field. At large reverse field, single magnetic domain was observed on the top of pyramidal islands. For field perpendicular to film plane, the coercivity of Fe films decreased as increasing the thickness of Ag layer. It indicated that Fe films grown on the sidewalls assisted magnetization reversal. Therefore, the magnetization reversal of Fe films can be realized by the perpendicular magnetic anisotropy of Fe films that deposited on the sidewalls of Ag pyramids.

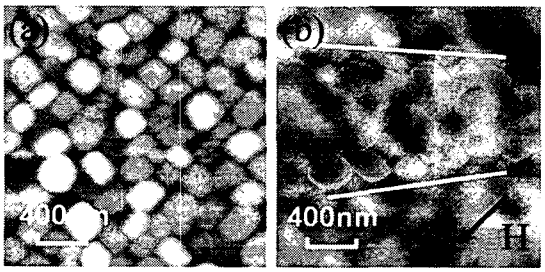

Fig. 2. (a) surface morphology and (b) magnetic force image of 50nm thick Fe films grown on 40nm thick Ag pyramidal islands

References

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