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Nucleation-type magnetization behavior in epitaxially grown FePt island-like films

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Magnetization process in hard magnetic materials with a large magnetocrystalline anisotropy is conveniently classified as the nucleation-type and the pinning-type. For example, the former is typically observed for Nd-Fe-B magnets, and the latter, for Sm-Co magnets. However, in the both cases, a high magnetic field is necessary to saturate the magnetization completely for getting a high coercivity (H_C); in other words, generally it is not easy to fully wipe out reversed domains at a low magnetic field. We reported that high H_C exceeding 70 kOe was achieved in highly ordered FePt (001) films with island structure, which were epitaxially grown on MgO (001) substrates [1]. In this paper, we will summarize the resent results [2] on the magnetization behaviour in comparison with domain observation for the FePt(001) films, indicating that they are ideal nucleation-type nanomagnets. Samples were prepared by multiple dc-sputtering with co-deposition of Fe and Pt directly onto single crystalline MgO (001) substrates heated up to 780 °C during the deposition. The structural analysis was performed by TEM and XRD. The magnetization was measured by SQUID and VSM with the maximum applied field of 140 kOe, and the domain observation was made by MFM. The FePt films with the nominal thicknesses from 20 to 50 nm consist of FePt islands with multiple domain structure in demagnetized state. The multiple domain structure is turned into single domain one at an applied field lower than 10 kOe, and the magnetization is saturated. When the applied field is reversed after the saturation, H_C reaches an almost full value more than a few tens kOe. This indicates that reversed domains are wiped out completely even at a low applied field, resulting in high H_C

[1] T. Shima et al. Appl. Phys. Lett. **81**, 1050 (2002),

[2] T. Shima et al. Appl. Phys. Lett. **85**, 2571 (2004).