【M-01】 초청강연

Direct Observation of Barkhausen Avalanche in Co Thin Films

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It is recognized that the magnetization reverses with a sequence of discrete and jerky jumps, known as the Barkhausen effect. Recently, interest in the Barkhausen effect has grown as it is a good example of dynamical critical behavior, evidenced by experimental observation of a power law distribution of the Barkhausen jump size. So far, most experimental studies have been carried out on bulk samples using a classical inductive technique, which is difficult to apply to thin films mainly due to the low signal intensity. In this talk, we report a direct domain observation of Barkhausen avalanche at criticality in Co thin films investigated by means of a magneto-optical microscope magnetometer (MOMM), capable of time-resolved domain observation in real time. Through a statistical analysis of the fluctuating size of Barkhausen jump from more than 1000-times repetitive experiments for each sample, distribution of Barkhausen jump size is found to exhibit a power law behavior and fitted as $P(s) \sim s^{-\tau}$ with critical exponent τ = 1.34 ± 0.07, 1.29 ± 0.06, 1.32 ± 0.03, and 1.30 ± 0.05 for 5, 10, 25, and 50-nm Co films, respectively, as plotted in Fig. 1. Most striking feature is the fact that the τ values are in the same universality class (~4/3) for all samples within the measurement error despite of the difference in the film thickness, which implies an invariance of the critical exponent τ irrespective of the

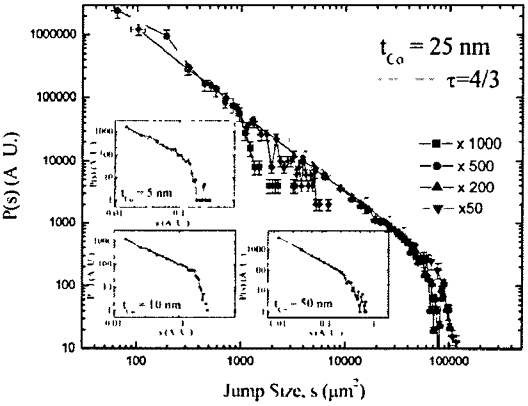

FIG. 1. Distribution of Barkhausen jump size.

number of defects in Co thin films.(1)

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1. D.-H. Kim, S.-B. Choe, and S.-C. Shin, Phys. Rev. Lett. 90, 87203 (2003).