

Parasitic magnetization in doped Cr₂O₃ antiferromagnetic film

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Magnetoelectric antiferromagnet Cr₂O₃ has received considerable attentions as a promising candidate for voltage controlled spintronic devices, since its antiferromagnetic spin reversal by applying both magnetic and electric fields have been demonstrated for Cr₂O₃ thin film systems [1,2]. Although Cr₂O₃ is an antiferromagnet, sometimes finite parasitic magnetization has been observed for Cr₂O₃ thin films; The origin of the parasitic magnetizations is still unclear, while it has attributed as the piezomagnetism [3], boundary magnetization [4], misfit dislocations [5], etc. We have observed positive exchange-bias phenomena in Cr₂O₃/Pt/Co thin film systems [6], which are also related to the parasitic magnetization in Cr₂O₃ films. Such a parasitic magnetization can utilize to reduce antiferromagnetic spin reversal energy in Cr₂O₃/Co exchange coupling system [7,8].

Recently we observed a larger parasitic magnetization in doped Cr₂O₃ film. In this study we investigated Al- and Ir- doping effect on the parasitic magnetization. With increasing both Al- and Ir-contents, the parasitic magnetization drastically increase; by about 3.7% Al-(Ir-) dope, volume magnetization of as large as 59 (4.9) emu/cc were obtained. Interestingly, the direction of the Cr₂O₃ volume magnetization against AFM domain is different between Al-doped and Ir-doped samples. In the case of Al-doped samples, the parasitic magnetization is parallel to the surface spin, while in the case of Ir-doped samples, it is anti-parallel to the surface spin. XRD results indicate both *a* and *c* value compression for Al-doped samples, and *a* and *c* value expansions for Ir-doped samples. Such a tuning of volume magnetization make Cr₂O₃ film more attractive.

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