

強磁性絶縁体 BaFeO₃ 薄膜における時間分解軟 X 線磁気円二色性の観測

Time-resolved XMCD study of ferromagnetic insulating BaFeO₃ thin films

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Fe⁴⁺ oxides have attracted great attention due to their various magnetic phases. While metallic SrFeO₃ thin films show helical magnetic ordering below $T_N = 115$ K, insulating BaFeO₃ thin films show ferromagnetism below $T_C = 111$ K by reducing the Fe 3d - O 2p hybridization through the lattice expansion [1]. We performed time resolved x-ray magnetic circular dichroism (XMCD) measurement on BaFeO₃ thin films in order to investigate the spin dynamics in this material [2]. A Ti-Sapphire laser (800 nm, 1.55 eV) was employed as a pump laser.

Figures 1 (a) and (b) show the XMCD and reflectivity evolutions with the delay time by the pump fluence of 3.3 - 10 mJ/cm². The time resolution is ~ 70 ps. With the low pump power, we observed slow demagnetization of ~ 150 ps, corresponding to the typical demagnetization time scale in insulators. There was no change in reflectivity intensity. In higher fluence, we observed fast changes about ~ 70 ps in both reflectivity and XMCD. The unusual fast changes in reflectivity and XMCD intensities for an insulator clearly suggest photo-induced insulator-to-metal transitions in BaFeO₃ thin films.

[1] S. Chakraverty *et al.*, PRB **88**, 220405(R) (2013), APL **103**, 142416 (2013). [2] T. Tsuyama *et al.*, PRB **91**, 115101 (2015), arXiv:1511.03365v1.

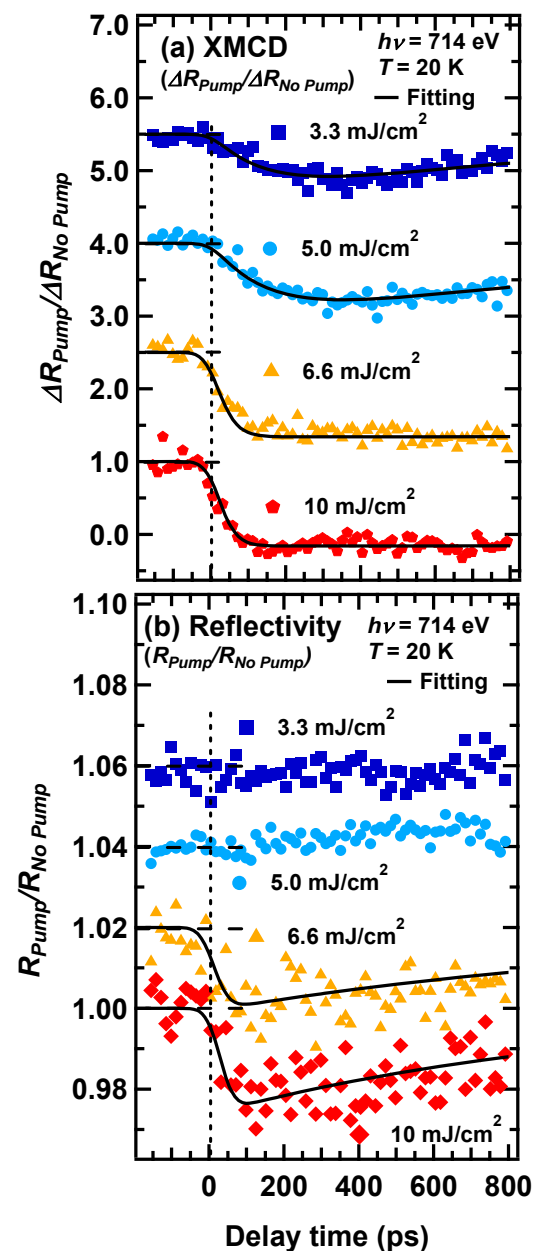


Fig. 1: Time evolution of (a) XMCD and (b) reflectivity of BaFeO₃ thin films for various pump laser fluence.