GdBaCo$_2$O$_{5.5}$薄膜で観測された光誘起強磁性-反強磁性転移

Photo-induced ferromagnetic-antiferromagnetic transition observed in GdBaCo$_2$O$_{5.5}$ thin films

REBaCo$_2$O$_{5}<x<6$, $RE$ is rare earth element) systems have been intensely investigated recently[1-3] for their intriguing physical properties such as high oxygen conductivity, metal-insulator transition, giant magneto-resistance and spin-state ordering, etc. Among them, GdBaCo$_2$O$_{5.5}$ exhibits a ferromagnetic (FM) –antiferromagnetic (AFM) transition at 255 K, which can be triggered by temperature and application of external magnetic field [3]. In this work, we investigated the dynamics of this FM-AFM transition by time-resolved x-ray magnetic circular dichroism (XMCD) and resonant x-ray magnetic diffraction (RXMD). The dynamics of FM and AFM ordering are separately monitored by XMCD and RXMD in one experiment system. By utilizing the excitation of 1.5 eV laser, we observed increase of XMCD signal (Fig. 1(a)) and decay of RXMD intensity (Fig. 1(b)), clearly indicating a photo-induced FM-AFM transition. Our results are the first case of photo-induced FM-AFM transition observed in oxide systems and are important to understand the magnetic properties and mechanism of FM-AFM transition in this system.

Figure 1: Time resolved (a)XMCD and (b)RXMD results of GdBaCo$_2$O$_{5.5}$ thin film.