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Optical spectroscopic study on new magnetoelectric hexagonal *RE*MnO_3 (*RE*=Gd, Tb, Dy, and Ho) thin films WOO SEOK CHOI, SUNG SEOK A. SEO, JUNG HYUK LEE, DAESU LEE, TAE WON NOH, ReCOE & FPRD, Department of Physics and Astronomy, Seoul National University, Seoul 151-747, Korea, YUNSANG LEE, Department of Physics, Soongsil University, Seoul 156-743, Korea — Recently, magnetoelectric effects in various oxides have been attracting lots of attentions and are being extensively investigated due to their intriguing couplings between the magnetic and electric order parameters. Here we report optical spectroscopic investigations on new hexagonal $RE$$MnO_3$ (RE = Gd, Tb, Dy, and Ho) thin films, which are fabricated by epi-stabilization technique [1]. From the in-plane optical conductivity spectra of the hexagonal $RE$$MnO_3$, we observe a dramatic increase of the optical transition related to Mn 3d a_{1g} energy level, as the ionic radius of the R ion increases. The optical transition at 1.64 eV for $DyMnO_3$ shifts to 1.67 and 1.81 for $TbMnO_3$ and $GdMnO_3$ respectively. For natural hexagonal $RE$$MnO_3$ (RE = Y, Er, Lu, and Sc) with smaller ionic sizes, the same optical transitions occur at ∼1.6 eV. The large peak shift in new hexagonal $RE$$MnO_3$ is understood by local flattening of Mn-O bipyramid, which will enhance the crystal field energy of a_{1g}, as the RE ionic size increases.
[1] J. H. Lee *et al.*, Adv. Mat., to be published (2006).

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