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Epitaxial thin film growth of garnet-, GdFeO_3 -, and YMnO_3 -type LuFeO_3 using pulsed laser deposition

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Abstract

Epitaxial thin-film growth techniques are useful for stabilizing metastable phases and controlling crystal-orientations. Herein, we report the fabrication of LuFeO_3 films using pulsed laser deposition. A garnet-type structure of the film was obtained because of epitaxial stabilization. The garnet-type LuFeO_3 film exhibits ferrimagnetism with a Curie temperature (T_C) of 260 K. This T_C is much lower than that of the $\text{Lu}_3\text{Fe}_5\text{O}_{12}$ garnet (550 K), as a result of the substitution of nonmagnetic Lu at the octahedral FeO_6 sites. We also fabricated GdFeO_3 -type LuFeO_3 epitaxial thin films and controlled the growth orientations of (001) and (011) of the $Pbnm$ structure by varying the substrates. The (001)-oriented YMnO_3 -type LuFeO_3 film could be stabilized on cubic substrates such as yttria stabilized zirconia (YSZ; (001) and (111)) and MgO (100).

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