Magnetic and magnetoelastic properties of epitaxial (211)-oriented RFe_2 (R: Tb, Dy) thin films

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With the rare earth (R) metals Tb and Dy, the cubic C15 Laves phase compounds RFe_2 exhibit the largest known magnetostrictive response at room temperature. A possible technological use of thin epitaxial films of these compounds in magnetostrictive devices requires the optimization of their properties with regard to sustaining a large magnetostrictive response even in moderate magnetic fields. We studied, in particular, the magnetostrictive response of RFe_2 (R: Tb, Dy) layers in the new epitaxial orientation (211) prepared by molecular beam epitaxy on faceted and non-faceted α-Al_2O_3 (10$\underline{1}$0) (m-plane) substrate surfaces. A detailed x-ray analysis was performed and revealed a twin-free (211)-oriented epitaxial growth. This same epitaxial growth was observed on the faceted and non-faceted m-plane surface, which implies a coherent overgrowth of the epilayer over the facet ridges. Magnetization and magnetostriction measurements on the films were performed with the magnetic field aligned along various high symmetry axes. The magnetoelastic coefficients of $TbFe_2$ and $DyFe_2$ films were determined and compared to those obtained for (111)- and (110)-oriented layers.