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Exchange coupling in MnBi/Fe-Co thin film bilayers[1] LEI FANG, TIEREN GAO, SEAN FACKLER, SHINGO MARUYAMA, ICHIRO TAKEUCHI, University of Maryland, JUN CUI, Pacific Northwest National Laboratory, M.J. KRAMMER, DUANE JOHNSON, Ames laboratory, ELKE ARENHOLZ, Lawrence Berkeley National Laboratory, JULIE BORCHERS, BRIAN KIRBY, WILLIAM RATCLIFF, NIST, RALPH SKOMSKI, University of Nebraska, SAMUEL LOFLAND, Rowan University — To achieve enhanced energy products of MnBi for rare-earth free permanent magnet applications, we studied the exchange coupled soft/hard bilayers based on MnBi films. By using DC magnetron sputtering, we fabricated pure MnBi films with magnetization of 500 emu/cc and coercivity of 1.6 T. A $(BH)_{max}$ of 6.2 MGOe is obtained for pure MnBi films. A large enhancement in $(BH)_{max}$ due to exchange coupling in MnBi/Fe-Co bilayers is observed with Fe-Co thicknesses between 2 and 5 nm. The highest $(BH)_{max}$ obtained is 14.0 MGOe at room temperature with a single phase magnetization curve for a MnBi (20 nm)/Co (2 nm) bilayer. TEM and XPS studies indicate there is no oxidation between soft/hard interface. The XMCD results show that the soft moments of Fe/Co at a thickness of 2 nm are perpendicular to the MnBi plane, indicating nearly perfect hard-soft coupling. Moreover, a micromagnetic calculation on perpendicularly-coupled MnBi/Fe-Co bilayers suggests a critical coupling thickness of 4 nm of the soft layer. We will also discuss results from polarized neutron reflectometry measurements performed on the bilayers.

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