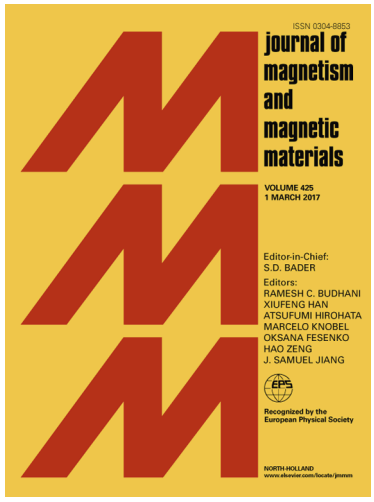

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Signature of Exchange Bias and Magneto-Electric Coupling in $BiFeO_3/SrRuO_3$ Heterostructure

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Abstract

The magnetic interaction between $BiFeO_3$ and $SrRuO_3$ layers in a heterostructure grown on (001) oriented $SrTiO_3$ substrate is investigated. A two-step magnetization reversal was observed in M-H hysteresis loop measurement of the heterostructure at 10 K. The first step in the hysteresis loop is associated with the switching of the free $SrRuO_3$ moments whereas the second step arises from the switching of the pinned moments. The total amount of the pinned $SrRuO_3$ moment was observed to decrease with increasing thickness of the $BiFeO_3$ layer. The presence of exchange bias effect in the heterostructure was confirmed by the field cooled M-H measurements where only the second step of hysteresis loop was observed to shift along the field axis. The coercivity of the second step of hysteresis loop decreases with increasing temperature and merges with that of the first step above 100 K which infers the desertion of the pinned magnetic moments. Temperature dependent capacitance measurement shows a kink at the ferromagnetic transition temperature of $SrRuO_3$ and a pronounced dip was observed in the second derivative of capacitance with respect to temperature, indicating a strong magneto-electric coupling between the two layers.

Keywords – Multiferroic; Heterostructure; Exchange Bias; Magneto-electric Coupling

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