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Modifying the magnetic reversal mechanism of an exchange biased partially oxides $\text{MnxOy}/\text{Ni}_{80}\text{Fe}_{20}$ bilayer through oxygen ion implantation

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Thin film sample $\text{Si}(001)//\text{SiO}_2/\text{Ni}_{80}\text{Fe}_{20}/\text{MnxOy}$ were ion sputtered. These sputtered samples were oxygen implanted using 8 keV ions at fluences of 1016, 1017 and 1018 ions/cm² in order to modify the exchange bias effect at the $\text{MnxOy}/\text{Ni}_{80}\text{Fe}_{20}$ interface. The magnetic, crystallographic and chemical properties of the sample were studied before and after the implantations using transmission electron microscopy, X-ray reflectometry, magnetometry and polarised neutron reflectometry. The results show an overall improved exchange bias and coercivity of the ion implanted samples. We observed a drastic magnetic and composition phase transition of MnxOy as a function of ion fluence. The 1017 ions/cm² implanted sample showed the highest improvement in exchange bias field and was therefore selected for studying its detailed spin reversal behaviour using polarised neutron reflectometry before and after implantation. The results reveal a coexistence of coherent and non-coherent magnetic spin reversal in the as-grown sample and a solely coherent spin rotation reversal mechanism for the implanted sample.

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