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Magnetic properties of Cr/Cr_{99.65}Ru_{0.35} hetero-structures

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Abstract content
   (Max 300 words)

Substantial focus has been placed on the investigation of magnetic properties in thin films and hetero-structures of Cr and Cr alloys, which have revealed fascinating properties not observed in bulk material [1]. These properties include the mediating role of Cr thin films in exchange coupled superlattices and in giant magnetoresistive (GMR) materials [2]. In order to broaden this knowledge, a previous contribution reported on dimensionality effects in epitaxial and polycrystalline Cr100-xRux alloy monolayer thin films, as well as on epitaxial Cr/Cr99.65Ru0.35 hetero-structures [3]. Conclusions from this study were based on resistivity as function of temperature measurements [3]. However, in order to fully understand the behaviour of the spin-density-wave (SDW) of Cr in these hetero-structure configurations, exploratory neutron diffraction studies were done on the Cr/Cr99.65Ru0.35 hetero-structures, following the same approach as for the Cr/Cr-Mn superlattices [1]. Epitaxial Cr/Cr99.65Ru0.35 hetero-structures were prepared by co-sputtering Cr99.65Ru0.35 layers from elemental sources onto MgO(100) substrates. Within the Cr/Cr99.65Ru0.35 structures the layer thickness of the Cr99.65Ru0.35 was held constant at 10 nm, while the Cr layer thickness was fixed at 10 and 50 nm, respectively. Samples were prepared to a total thickness of 700 nm. The concentrations and thicknesses of the films and hetero-structures were confirmed using Rutherford Back Scattering techniques. The neutron diffraction studies were performed on the Taipan triple-axis spectrometer at ANSTO (Australia). By utilizing the triple-axis instrument in elastic mode a very low background contribution in the detector could be attained, thus providing a sensitive probe for the small magnetic moments present in the thin Cr/Cr-Ru hetero-structures. The temperature dependence of the neutron results indicates the existence of the paramagnetic phase, as well as commensurate and incommensurate SDW phases in these samples. These results confirm key characteristics of the magnetic ordering and warrant further more comprehensive studies.

REFERENCES
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