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The magnetic properties of Cr + 1 at.% Al thin films

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Abstract content (Max 300 words) Formatting & Special chars

Pure bulk Cr has an electron-to-atom ratio (e/a) of six and exhibits a Néel temperature (TN) at 311K [1]. Studies on dilute Cr alloys show that alloying Cr with elements with $e/a > 6$ results in an increase in TN, whilst alloying with elements rendering an $e/a < 6$ results in a decrease in TN [1]. In Cr_{100-x}Al_x, where Al has $e/a = 3$, the phase diagram shows a sharp decrease in TN values, reaching a minimum near $x = 2$, where after the TN values again increase [1,2]. As thin films of Cr alloys generally show properties not observed in the bulk [3], this study extends investigations to Cr₉₉Al₁ thin films with thicknesses (t) varying from 28 to 450nm deposited on fused silica, MgO(100) and MgO(110). XRD was used to determine the crystallographic orientations of the films. Results show epitaxial growth in films prepared on the MgO substrates, while those on fused silica are polycrystalline. TN values were obtained from standard four-point probe resistance (R) investigations as function of temperature. For samples deposited on fused silica no anomalies were observed, while $R(T)$ curves for films deposited on MgO showed anomalies in the forms of domes associated with TN. It has been found that these TN values decreased with increase in t , levelling off at approximately 260K for the 450nm sample. This result correlates with the TN value expected from the magnetic phase diagram of bulk Cr₉₉Al₁ [1].

[1] E Fawcett et al., Rev. Mod. Phys. 66 (1994) 25

[2] CJ Sheppard et al., J. Alloys Compd. 595 (2014) 164

[3] HJ Zabel, J.Phys.: Condens. Matter 11(1999) 9380

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Main supervisor (name and email) and his / her institution

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