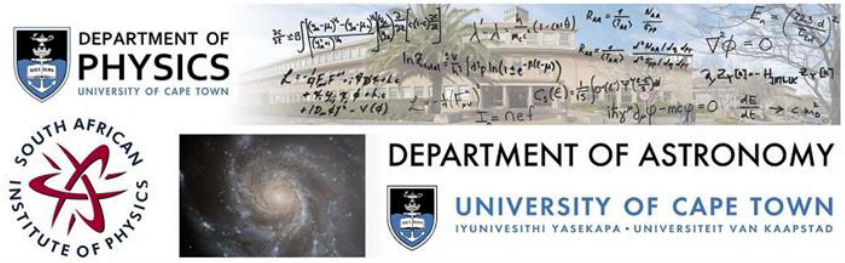

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Magnetic properties of Cr +2.9 at.% Al thin films

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Abstract content
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Cr is an itinerant antiferromagnet with an incommensurate spin density wave structure, have an electron to atom ratio (e/a) of six and exhibits a Néel transition at TN = 311K [1]. If Cr is doped with elements with e/a > 6 an increase in TN is observed, while doping Cr with elements whose e/a < 6 results in TN decreasing [1]. However, despite the fact that Al has an e/a = 3, the Cr-Al magnetic phase diagram rather shows a sharp decrease in TN values, reaching a minimum near 2 at.% Al, where after the TN values unexpectedly increase [1, 2]. As thin films of Cr and its alloys show properties not observed in the bulk [3], this study extends existing knowledge through an investigation on Cr-Al alloy thin films. Cr97.1Al2.9 thin films of thickness 23 to 368 nm were deposited on fused silica, MgO(100) and MgO(110) using the DC magnetron sputtering techniques. X-ray diffraction was used to determine the structural properties of the films. Results obtained shows epitaxial growth for the films prepared on MgO, while those prepared on fused silica substrates are polycrystalline. Magnetic transition temperatures were obtained using standard four-point probe resistivity (&rho) as function of temperature (T) measurements. For samples deposited on fused silica no anomalies in ρ(T) associated with the TN are observed. ρ(T) curves for the films deposited on MgO showed weak anomalies in a form of domes associated with TN. In some cases these anomalies were weak resulting in difficulties in obtaining TN values. Interestingly, TN values found correlate well with those found in the magnetic phase diagram of bulk Cr-Al.
[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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