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# Residual stress in polycrystalline thin Cr films deposited on fused silica substrates

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## Abstract content <br> &nbsp; (Max 300 words)<br><a href="http://events.saip.org.za/getFile.py/starget="\_blank">Formatting &<br>Special chars</a>

The Néel temperature (<i>T</i><sub>N</sub>) in thin film Cr coatings is strongly influenced by dimensionality effects, as well as strain and stress [1]. In an investigation of Cr thin films with thickness (<i>t</i>) varied between 20 and 320 nm deposited on fused silica substrates, the <i>T</i><sub>N</sub> values obtained from resistivity measurements indicate an increase with thickness as expected [1]. However, it is noted that the <i>T</i><sub>N</sub>  $\approx$  460 K obtained for the <i>t</i> = 320 nm sample, is considerably higher than the transition temperature of 311 K obtained in bulk pure Cr. This behavior is unexpected, but incidentally corresponds with <i>T</i><sub>N</sub> = 475 K obtained for the CSDW-P Néel transition in bulk Cr when influenced by stresses introduced by cold working [3,4]. Since stresses are well known to influence the physical properties of materials [1,2], amongst others the magnetic properties, this study is now extended to investigations of the in-plane stresses in these thin films. This is done using the specialised X-ray diffraction sin<sup>2</sup>&psi-method [2,5,6]. With this technique, variations in the lattice plane spacing is accurately determined from the precisely measured (310) Bragg peak position as function of systematically increased tilt angles, &psi, from the surface normal to as close as achievable to the in-plane direction. The in-plane residual strain present in the coating (&epsilon) is determined from the slope of a linear plot through the fractional change in the plane spacing (or Bragg peak position) versus sin<sup>2</sup>&psi plots. Residual stress (&sigma) are calculated from the &epsilon versus sin<sup>2</sup>&psi data by incorporating the elastic properties of the coating material. The results indicate tensile stresses in all the samples. Results will be used to correlate the <i>T</i><sub>N</sub> values to the stresses in the coatings. References:

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[4] Prinsloo ARE et al. 2010 <i>J. Magn. Magn. Mat.</i>> 322 1126

[5] Society for Automotive Engineering, Residual Stress Measurement by XRD, 2nd edition 1971 SAE J748a

[6] Noyan IC, Cohen JB, Residual Stress, Measurement by Diffraction and Interpretation, Springer-Verlag, New York, 1987

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MSc

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### Would you like to <br> submit a short paper <br> for the Conference <br> Proceedings (Yes / No)?

yes

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