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Elastic constants of Cr₃C₂ thin films by surface Brillouin scattering investigations

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**Abstract content (Max 300 words)
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Thin hard films of transitional metal carbides have continued to be extensively investigated due to their widespread application as protective coatings. This is made possible by their excellent properties such as high hardness, high melting temperature, and chemical inertness under extreme environments. In this work, we investigate the propagation of surface acoustic wave and determine the elastic constants of Cr₃C₂ films on (001) Si. Cr₃C₂ thin films were deposited on etched (001) Si at a working gas pressure of 1.0 x10⁻³mbar and sputter power of 175W. The deposition rate, film density and interfacial roughness have been determined using X-ray Reflectometry (XRR). Surface Brillouin studies have shown the presence of Sezawa waves which indicate high film quality and low surface roughness as confirmed by X-ray Reflectometry. The dispersion curves have been used to extract the elastic constants to C₁₁ = 275GPa, C₃₃= 370GPa, C₅₅= 86.9GPa and C₁₃= 101GPa. The low values of the elastic constants are attributed to the microstructure of sputtered thin film which is less dense than the single crystal. The elastic anisotropy of the film shows that it is stiffer in direction perpendicular than parallel to the film (c₁₁/c₃₃ < 1) which is characteristic of thin films that have a columnar growth structure based on the zone structure model [1-2].

Keywords: elastic constants, transitional metal carbides, surface Brillouin scattering.

References

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No

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