ATOMIC LAYER DEPOSITION AND CHARACTERIZATION OF CHROMIUM-ALUMINIUM OXIDE FILMS

Mahtab Salari Mehr[1], Lauri Aarik[1], Taivo Jõgiaas[1], Aarne Kasikov[1], Jekaterina Kozlova[1], Hugo Mändar[1]

[1]*University of Tartu, Institute of Physics, W.Ostwald Str.1, 50411 Tartu, Estonia*

Mahtab.salari.mehr@ut.ee

Aluminum oxide and chromium oxide are renowned materials for their corrosion and wear resistance properties, and high mechanical hardness. According to previous research reports, doping Al_2O_3 with Cr_2O_3, or vice versa, can tailor film properties for diverse applications [1-4]. This study investigates the growth, mechanical and optical properties of Cr_2O_3, and chromium-aluminium oxide (CAO) films deposited via the atomic layer deposition method on Si substrates at a deposition temperature of 275 °C. Cr_2O_3 exhibited a crystalline microstructure containing the α-Cr_2O_3 eskolaite phase. HRSTEM analysis confirmed the presence of nanocrystallites in the CAO films. The CAO films demonstrated enhanced hardness (Fig. 1) due to an amorphous/crystalline nanocomposite structure and showed an 80% improvement in wear resistance over Cr_2O_3 films. The optical properties of the films showed significant dependence on the Al concentration. By annealing up to 900°C, a transition layer with a density of 2.8 g/cm³ formed in Cr_2O_3 films, which was nearly absent in CAO films, indicating their superior oxygen diffusion barrier properties.

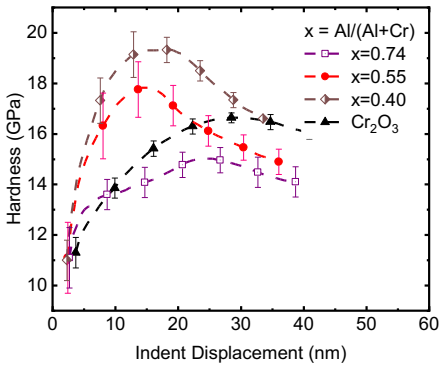

Fig.1 Mean values of hardness in variation of indent displacement for Cr_2O_3 and ternary chromium-aluminum oxide (CAO) films.

References

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