

Investigation of Tribological Behavior of Electrodeposited Cr, Co-Cr and Co-Cr/TiO₂ Nano-Composite Coatings

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Abstract : Electrodeposition is a simple and economic technique for precision coating of different shaped substrates with pure metal, alloy or composite films. Dc electrodeposition was used to produce Cr, Co-Cr and Co-Cr/TiO₂ nano-composite coatings from Cr(III) based electrolytes onto 316L SS substrates. The effects of TiO₂ nano-particles concentration on co-deposition of these particles along with Cr content and microhardness of the coatings were investigated. Morphology of the Cr, Co-Cr and Co-Cr/TiO₂ coatings besides their tribological behavior were studied. The results showed that increment of TiO₂ nano-particles concentration from 0 to 30 g L⁻¹ in the bath increased their co-deposition and Cr content of the coatings from 0 to 3.5 wt.% and from 23.7 to 31.2 wt.%, respectively. Microhardness of Cr coating was about 920 Hv which was higher than Co-Cr and even Co-Cr/TiO₂ films. Microhardness of Co-Cr and Co-Cr/TiO₂ coatings were improved by increasing their Cr and TiO₂ content. All the coatings had nodular morphology and contained microcracks. Nodules sizes and the number of microcracks in the alloy and composite coatings were lower than the Cr film. Wear results revealed that the Co-Cr/TiO₂ coating had the lowest wear loss between all the samples, while the Cr film had the worst wear resistance.

Keywords : Co-Cr alloy, electrodeposition, nano-composite, tribological behavior, trivalent chromium

Conference Title : ICMMSSE 2015 : International Conference on Metallurgy, Materials Science and Engineering

Conference Location : Prague, Czechia

Conference Dates : July 09-10, 2015