Effect of N₂ Flow Rate on Structure and Corrosion Resistance of AlCrN Coatings Prepared by Multi-Arc Ion Plating

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AlCrN coatings are deposited on high-speed steel by a multi-arc ion plating technique at various N₂ flow rates. The effects of N₂ flow rate on microstructure, elemental composition, deposition rate and corrosion properties of the AlCrN coatings are investigated. The results indicate that the macroparticles and pits on the coating surfaces can be reduced with raising the N₂ flow rate, so that the surfaces become flatter. For the N₂ flow rate ranging from 300 to 500 sccm, the phases of the coatings are composed of intermetallic phase AlN and fcc-(Cr, Al) N with (111) preferred orientation, causing the decrease of growing tendency towards preferential orientation. Then with increasing the N₂ flow rate to 700-900 sccm, the coatings exhibit a single (fcc) phase. In the case of 900 sccm, the corrosion resistance of AlCrN coated sample exhibits a improvement with the highest electrode potential and the lowest corrosion current density when compared with the other coated samples. After appropriately increasing the N₂ flow rate, the AlCrN coating becomes a potential material for corrosion resistance.

Keywords: Corrosion resistance; AlCrN; Nitrogen flow rate; Multi-arc ion plating

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