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Effect of work function and cohesive energy of the constituent phases of Ti-50 at.% Al cathode during arc deposition of Ti-Al-N coatings

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Abstract

The differences in work function (W.F.) and cohesive energy (C.E.) of the phases constituting the cathode, plays an important role in the formation of the converted layer at its near-surface region during cathodic arc deposition. As a consequence, this also affects the deposition conditions for the coatings. In this study, we explore the effect of W.F. and C.E. of the constituent phases during arc evaporation by utilizing two kinds of customized Ti-50 at.% Al cathodes with different phase compositions. Our results show that during reactive arc evaporation the disparity in W.F. and C.E. among the constituent phases of Ti-50 at.% Al cathodes leads to preferential erosion of the phases with lower W.F. and C.E.. The aforementioned preferential erosion begets higher surface roughness on the Ti-50 at.% Al cathode with a wider range of W.F. and C.E. disparity. It is also observed that the thermal conductivity of the Ti-50 at.% Al cathode plays a dominant role in the deposition rate of Ti-Al-N coating. This article also presents how the