
Improvement of Oxidation-resistance of CrN films by Plasma Ion Implantation Based on High-power Pulsed Magnetron Sputtering

Yinghe Ma^{*1}, Z.z. Wu , C. Z. Gong , and Xiubo Tian[†]

¹State Key Lab. of Advanced Welding Joining – Harbin Institute of Technology, 150001 Harbin, China

Abstract

CrN films were deposited by high power pulsed magnetron sputtering/plasma ion implantation and deposition (HPPMS-PIID) process on the surface of stainless steel samples. Cr films were prepared as interlayer. High-temperature performance of CrN coatings prepared by different processing parameters and annealing temperatures were investigated. The change of phase structure, hardness and corrosion resistance of CrN films after annealing treatment was obtained. The results showed that CrN grains were of columnar crystals which were arranged quite closely without obvious defects such as "holes". Mixing zone with about 40nm in width showed a good mixing between the film layer and the substrate. Continuous transition regions were formed between the substrate and the film layer. CrN films exhibited highly preferential orientation of CrN (200) peak with other peaks of relatively small intensity. With annealing temperature increasing, CrN (200) peak intensity gradually decreased. Cr₂N (111) peak appeared after 600 °C with peak intensity increasing when annealing temperature increased. When annealing temperature reached 800 °C, all CrN (200) peak were transformed into Cr₂N (111) peak. No peak of oxides demonstrated a good oxidation resistance of deposited CrN films. After annealing, there was no significant corrosion degrade of CrN samples.

Keywords: high power pulsed magnetron sputtering, plasma ion implantation & deposition, CrN, oxidation resistance

*Speaker

†Corresponding author: xiubotian@163.com