PO3021

Relationship between oxidation behavior and coating property of AIP deposited AlCrN coating with high Al content

KENJI YAMAMOTO[1], Hiroaki Nii[1], Shinya Takada[2], Yoshiro Iwai[2]

[1]Kobe Steel Ltd., Kobe, Japan [2]University of Fukui, Fukui, Japan

yamamoto.kenji1@kobelco.com

AlCrN coating has been used for various metal working tools including cutting tools and molds / dies for increasing wear resistance. Makino et al. reported, based on theoretical calculation called band-parameter method, AlCrN can maintain cubic phase at higher Al content (77.2 at%) than AlTiN (65.3 at%) [1]. Reiter reported property of AIP deposited AlCrN coating with different Al composition and reported that highest tool life in cutting test was obtained at 71 at% of Al, primarily due to high hardness, oxidation resistance and abrasion resistance which is related to presence of hexagonal phase [2]. In this study, AlCrN coatings with different Al compositions, particularity Al composition close to the maximum solubility, were synthesized by cathodic arc and mainly effect of substrate bias on coating property was investigated. AlCr targets with 65, 70, 75 and 80 at% of Al were used. Coatings were deposited by a laboratory type AIP equipment (Kobe Steel Ltd.) under N_2 atmosphere at 4 Pa, Iarc=150A. Substrate bias was varied from 20 to 175V. Oxidation behavior was investigated by annealing samples in air at 800, 900 and 1000 °C for 30min and surface O composition was measured by EDX. Coatings deposited using Al75Cr25 target, surface O concentrations were low at each annealing temperature for coating deposited at substrate bias between 70 to 150V compared to one at 40V. Contrary to this, O concentrations of coatings deposited using Al70Cr30 target were constant independent of substrate bias. XRD analysis confirmed that coatings deposited using Al70Cr30 target were all in cubic single phase, whereas coatings deposited using Al75Cr25 target, coatings deposited at low substrate bias were mixture of cubic and hexagonal phase and coatings deposited between 70 to 150V were cubic single phase. This substrate bias dependent difference in crystal structure can explain the different oxidation behavior.

[1] Y. Makino: ISIJ International,38 (1998) 925
[2] Reiter et al. Surf. Coat. Technol. 200 (2005) 2114– 2122

Keywords
AIP
oxidation
AlCrN
cuttingtest