



Mechanical performance of AlCrSiN coating with Zr/Ta ion implantation on WC-Co hard metals

Jing Liang^{1*}, L. Ortiz-Membrado¹, S. García-González¹, J. Orrit-Prat³, R. Bonet³, J. Caro³, J. Fernández de Ara⁴, E. Almandoz^{4,5}, L. Llanes^{1,2}, E. Jiménez-Piqué^{1,2}

¹ CIEFMA - Department of Materials Science and Engineering, EEBE, Universitat Politècnica de Catalunya-BarcelonaTECH. Avda. Eduard Maristany 16, 08019 Barcelona, Spain

² Barcelona Research Center in Multiscale Science and Engineering- Universitat Politècnica de Catalunya-BarcelonaTECH. Avda. Eduard Maristany 16, 08019 Barcelona, Spain

³ Eurecat, Centre Tecnològic de Catalunya, Unit of Metallic and Ceramic Materials, Plaça de la Ciència 2, 08243 Manresa, Spain.

⁴ Centre of Advanced Surface Engineering, AIN, 31191 Cordovilla, Spain

⁵ Science Department, Universidad Pública de Navarra (UPNA), Campus de Arrosadía, 31006 Pamplona, Spain

* E-mail: jing.liang@upc.edu

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ABSTRACT

Ceramic coatings are being widely used in the tool industry to protect the surface in order to further enhance the mechanical performance in wear and corrosion resistance. In this work, AlCrSiN coatings on WC-Co substrates have been deposited, and afterwards subjected to an ion implantation procedure with Zr and Ta atoms. Microstructure was characterized by SEM, FIB and EDX. Surface analysis was performed with XPS, showing that the amount of Cr-nitride phase after ion implantation was higher than sample without ion implantation which illustrate the combination of Cr and N was increased.

Mechanical testing was done by nanoindentation, contact loading and scratch testing. AlCrSiN coatings with Zr or Ta ion implantation presented better adhesion with WC-Co substrate than samples with no ion implantation, showing less cracking during initial loading. The failure mode for samples with Zr and Ta ion implantation were similar, but the sample with no ion implantation presented a clear and neat spallation from the substrate. Samples with ion implantation perform a better adhesion than no ion implantation under a progressive scratch loading.

Contact load resistance was done with a Mercedes Test. In this test, AlCrSiN coatings deposited on WC-Co implanted with Ta ion demonstrated better integrity than samples with Zr ion implantation and with no ion implantation, presenting failure at larger loads.

As a conclusion, Zr and Ta ion implantation could improve the adhesion between AlCrSiN coating and WC-Co substrate.