TRIB1-O1-005 ● Mechanical properties and corrosion behaviour of DLC monolayers and multilayers deposited over nitrided martensitic stainless steel

S. Brühl [1], E.L. Dalibón [1], V.J. Trava-Airoldi [2], A. Cabo [3]

[1]UTN National University of Technology - Concepción Del Uruguay (AG), [2]INPE - Sao Jose Dos Campos, Sp (BR), [3]IONAR S.A. - San Martin (AG)

DLC coatings have unique properties such as a very low coefficient of friction and chemical inertness and they are used extensively as protection and solid lubricants in many industrial applications. Nevertheless, adhesion over certain substrates like stainless steel has many unresolved issues, as well as corrosion mechanisms are not well understood [1,2].

Two possibilities to improve adhesion and corrosion resistance are using multilayer coatings and a pretreatment. In this work, monolayers and multilayer amorphous hydrogenated DLC films obtained by PACVD are studied when deposited over martensitic stainless steel which was previously plasma nitrided compared with others without pre treatment.

Nanohardess was performed to evaluate mechanical properties of both type of coatings: one monolayer and multilayer film built with five layers. Adhesion was measured with Scratch Test and Rockwell C indentation. Corrosion was evaluated with growing potential steps until the pitting failure occurred. Pits, scratches and indentation scars were evaluated by SEM and SEM-FIB in the cross section.

Hardness and Young Modulus were similar, but adhesion improved from one layer to the multilayer and with the nitrided layer as pre treatment. This result is consistent with wear behaviour of these duplex coatings published previously [3]. Corrosion resistance was only acceptable in the case of the duplex multilayer. Pits analysis revealed the integrity of the multilayer system and how only one layer was attacked (figure). In other cases, with passing through defects, the film did not detach even though the substrate degraded beneath it.

Thanks/Acknowledgement

To the finantial support of UTN and FRCU, PID UTI 4716 TC.

References

[1] M. Azzi, P. Amirault, M. Paquette, J. E. Klemberg-Sapieha, L. Martinu. Surf. Coat. Technol. 204 (2010) 3986–3994.

[2] S. Delfani-Abbarik, A. Abdollah-Zadeh, S. M. Mehdi Hadavi, M. Abedi, S. M. Reza Derakhshandeh. Surf. Coat. Technol. 350 (2018) 74-83.

[3] E. L. Dalibon, J. N. Pecina, A. Cabo, V. J. Trava-Airoldi, Sonia P Brühl. J. Mat. Res. Technol., in press. https://doi.org/10.1016/j.jmrt.2017.12.004

Multilayer corrosion attack