ADHESION COMPARISON OF DLC FILMS OVER TI6AL4V ALLOY AND 316 STAINLESS STEEL BY USING DIFFUSION AND SUPERFICIAL TREATMENTS

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1. Introduction

DLC films has attracted attention due to their remarkable properties, such as, low friction, high hardness, excellent wear and corrosion resistance [1,2]. However, the high levels of compressive stresses, which arise during film growth, turn it difficult to obtain high adhesion. Furthermore, the film's high hardness combined with the difference of its thermal expansion coefficient, compared to the substrate, causes the DLC film not easily follow the substrate deformation, which can lead to delamination and total failure of the coating. [3].

2. Experimental

DLC films were grown over Ti6Al4V alloy and 316 stainless steel trough Plasma Enhanced Chemical Vapor Deposition. In order to enhance adhesion between coating and substrates, two processes were evaluated. Before films deposition, one samples group was prepared by carbonitriding with 80% nitrogen in gas mixture. For the other group of samples a silicon interlayer was deposited by using silane gas atmosphere. Raman Spectroscopy was used to analyze structural arrangement of carbon atoms. Scratch test and Rockwell C indentation was performed in order to evaluate DLC adhesion on substrates. SEM images were used to analyze films morphology and indentations.

3. Results and Discussions

Figure 1 shows Rockwell C indentation of DLC grown after carbonitriding process for Ti6Al4V alloy and 316 stainless steel, while Figure 2 shows indentations of the films grown after silicon interlayer deposition. It can be seen that carbonitriding process did not have the same efficiency to provide good adhesion of DLC films for both materials. However, the use of a silicon interlayer results in films with good adhesion for Ti6Al4V and 316 steel. This can be related to the influence of deposition temperature used in which process.

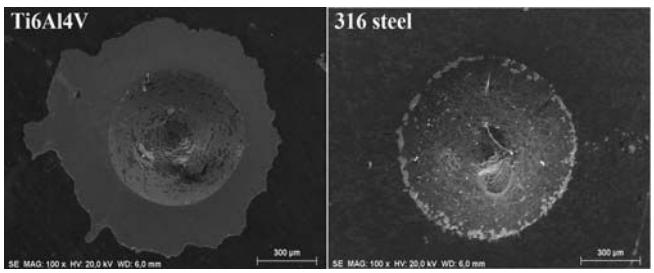

Fig. 1. *Rockwell indentation images for DLC grown over Ti6Al4V alloy and 316 steel after carbonitriding process.*

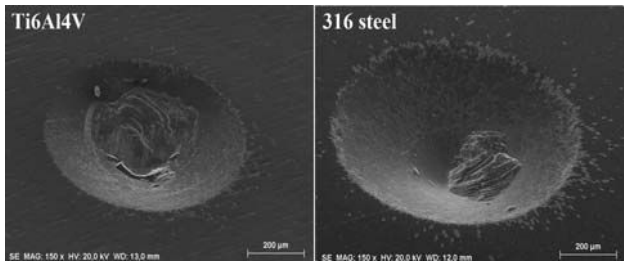

Fig. 2. *Rockwell indentation images for DLC grown over Ti6Al4V alloy and 316 steel after silicon interlayer deposition.*

4. References

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Acknowledgments

The authors would like to thank FAPESP and CAPES for financial support.

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