Evaluation of fretting wear behaviour of DLC hard coatings deposited on stainless steel

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Diamond like carbon coatings have chemical inertness, low friction coefficient and good wear resistance. There are a lot of publications about tribological behaviour of these coatings [1] but a few about fretting wear [2]. In this work, the wear resistance in a fretting situation was evaluated in different conditions (changing the test duration and the applied load) using an alumina ball as counterpart. The coatings were deposited by PACVD on nitrided and non-nitrided AISI 420 martensitic stainless steels (duplex and coated samples respectively). The microstructure was characterized by Raman spectroscopy, OM, SEM and XRD. The hardness and Young´s modulus E were measured by nanoindentation, adhesion by Scratch Test and Rockwell C Indentation. The coating thickness was 3 µm and the nitrided layer, 13 µm. The coating hardness was about 20 GPa and E resulted in 160 GPa. In the fretting tests, the wear volume increased with load and time but the duplex samples had better behavior than the coated sample, which in a 12 N load test of one-hour duration, the coating was broken and detached. The critical load in the duplex sample was 47 N and 9 N in the coated sample. In the Rockwell C Indentation test, the adhesion was acceptable only in the duplex sample. In both adhesion tests, the nitrided layer reduced the stresses and improved the adhesion.

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