Tribological Evaluation and Behavior of DLC coatings on steel in PECVD system with TiO2 over layer using ALD technique.

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Diamond-Like Carbon (DLC) coatings have attracted significant attention due to low friction, high hardness and high wear resistance. These films meet conditions that can be used in some mechanical applications in aerospace, medical and automotive industries. The major disadvantage of these coatings is a low adhesion on metallic substrates, caused by elevated compressive residual stresses after deposition. Some plasma conventional methods require a high consumption of energy that are used to grow DLC films, resulting in a high level of temperature and pressure during the deposition, which affects the adhesion of the film to the substrate. DLC coatings were deposited employing an asymmetrical bipolar pulsed-DC PECVD system, in a very low temperature and pressure (about 87° C and 0.1 Pa) which allowed lower level of collisions and a higher plasma density. Methane gas was used as a precursor. In order to overcome low adhesion of DLC films on steel substrate, a thin amorphous silicon interlayer was deposited at the interface, and to the last process was to deposit a thin TiO2 film over DLC using ALD Technique. Resulting coatings were observed with SEM and Raman spectroscopy to analyze atomic arrangement. The total residual stress was evaluated by the curvature method. The tribological behavior (friction and wear) was analyzed by lubricated reciprocating wear tests at room temperature. The elevated coating hardness (higher than 25 GPa) promoted good wear resistance. These results suggest that the PECVD-DC Pulsed with additional cathode and methane as a precursor gas to grow DLC films on metallic substrates may represent a new alternative to improve the mechanical behavior in some applications.