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Substrate biasing effects on the mechanical and tribological properties of thick DLC coatings obtained by HiPIMS

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The mechanical and tribological properties of DLC coatings makes them suitable for a wide class of applications, making use of their high hardness, low friction coefficient and chemical inertness. Depending on the specific required properties different PVD or PECVD deposition techniques can be used for the synthesis of such coatings. In this contribution we will refer to both hydrogen free and hydrogenated DLC coatings obtained by using magnetron sputtering in a HiPIMS process. The target conditions were optimized to obtain a high current regime, without triggering a significant number of micro-arcing events. DLC films were deposited both on Si and 304L steel substrates, using a Ti based interlayer to improve the adhesion and mechanical stability of the coating. The main substrate parameter used for controlling the film properties is the bias voltage, both in terms of absolute values and type of biasing. In this respect, RF and synchronized pulsed bias were used and compared as alternatives for applying the negative voltage on the substrate. The micrometer thick DLC coatings obtained on steel substrates were characterized using standard tribological testing, in both dry air and lubricating oil environment. Scratch test performed in the 0 to 100 N force interval revealed good adhesion to the substrate, with critical loads exceeding 20-30 N for most of the samples. A comparison between deposition conditions is provided, aiming to link the process conditions with the mechanical performance of the coatings.
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