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Tuning the HiPIMS sputtering process of C target for the deposition of DLC coatings

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The use of HiPIMS technology for a variety of applications is continually expanding in the last decades. The higher flux of ionized particles reaching the substrate and the ability to tune their energy represent major advantages, differentiating the HiPIMS process from classical magnetron sputtering. In this contribution we present experimental results on the development of C sputtering process using HiPIMS, aiming for the deposition of dense, thick and well adherent DLC coatings. The process optimization and tuning of the ion flux to the substrate is achieved by using a few key parameters, aiming to improve the stability of the process and increase the deposition rate. The first type of parameters refer to the pulse characteristics where the peak voltage and peak current are used for controlling the type of sputtering regime and the pulse width for controlling the stability of the process. The second type of parameters are related to the gas composition, using Ar and a mixture of Ar/Ne as sputtering gases, use of Ne being known to produce higher electron temperature and deliver correspondingly higher ionization degree. Moreover, the reactive version of the process using both C_2H_2 and CH_4 as gas precursors is also investigated for DLC deposition. The use of these parameters enables the tuning of the process in a wide process interval, going from low current DC-like sputtering, passing through transitory regimes prone to instabilities, to finally reach stable high power sputtering in usually narrow process intervals and being bounded by a micro-arcing regime. Typical DLC coating properties for selected conditions will also be presented, establishing a link between process conditions and film properties.
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