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Characterization of hydrogen-free amorphous carbon films by filtered vacuum arc on stainless steel

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For the last ten years, carbon based thin films have been widely studied due to their interesting physical and chemical properties, such as high hardness, low friction coefficient, optical transparency, high thermal conductivity and biocompatibility. However, these films still present many disadvantages for industrial use, such as low adhesion on stainless steel substrates and high internal stress.
In this work non hydrogenated amorphous carbon (a-C) films deposited by a filtered dc vacuum arc discharge on stainless steel were studied. A titanium interlayer grown by vacuum arc was introduced in order to improve the adhesion of the coatings. Both floating and negatively biased substrates with a voltage of 100 V were used to adjust hardness and elastic modulus of the carbon films. The properties of the coatings were characterized by scanning electron microscopy, x-ray photoelectron spectroscopy, secondary ion mass spectroscopy and Raman spectroscopy. The a-C films were found to have a layered structure, consisting of an sp^2-rich surface layer, a bulk film and an sp^3-dominated layer near the interface with the titanium coating. No evidence of carbide formation was found at this interface.

Keywords
carbon thin films
arc deposition
Raman spectroscopy