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The influence of the H content on the properties of metal doped carbon base coatings

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There is a myriad of carbon-based coatings allowing presenting almost any value of the wide ranges of properties that a material can present. This is the reason why they are being selected for many different types of applications from electronic devices up to power train engines to reduce friction and wear. Hydrogen is one of elements that can influence significantly the mechanical properties and the tribological behaviour of DLC coatings. The determination of the hydrogen content requires certain types of techniques which are very often not available in many research centres. Thus it is important to find alternatives to make an estimation of the H content using indirect techniques or procedures accessible to most of laboratories can have access, as Raman spectroscopy or, simply, measuring the hardness of the coatings. Carbon base coatings doped with W were deposited by PVD magnetron sputtering in a reactive Ar+CH4 atmosphere with different CH4 flows in order to achieve different H contents. The adhesion of the coatings deposited on steel substrates was evaluated by conventional scratch test and no significant differences were observed for the different H content. The hardness evaluated by nanoindentation decreased from 16 to 6 GPa with increasing CH4 flow. Rutherford Backscattering Spectrometry, Elastic Recoil Detection Analysis and Proton Induced X-ray Emission were used for determining the chemical composition across the coating thickness as well as the H content. The results show that the coatings have a Cr interlayer and a transition region to the DLC layer. A linear relation was found between the hardness values and the H content. Similarly, Raman results were analyzed and the slope of the baseline was possible to be correlated either with hardness and the H content, indicating that these indirect methods can give a rough estimation of the H content.

Keywords
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