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MS-3-P-2082 Microscopic study of TiC/ amorphous C thin films

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The combination process of Ti and C is relatively easy and cheap, and at the same time TiC possesses good mechanical properties. The formation of TiC based surface coating has a passivation effect to titanium implant.

In this work, structural and phase changes depending to the Ti content in the films were studied. 135 nm thin nanocomposite thin films were deposited by DC magnetron sputtering on Si/SiO_2 substrates in argon atmosphere at room temperature and 0.25 Pa. The input power of carbon target was constant (150 W), while the input power of titanium target was changed between 5 and 70 W. All films were characterized by Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM) and High Resolution Electron Microscopy (HREM). The elemental composition of the films was measured by Energy Dispersive Spectroscopy (EDS) using TEM equipped with a NORAN cooled Ge detector. X-ray Photoelectron Spectroscopy (XPS) was used for matrix characterization. In all cases, XPS and TEM observations confirmed the two main phase; amorphous carbon + carbide phase until 30 W of Ti power and graphitized carbon + carbide phase above 30 W of Ti power. The average size of crystallites increased with higher Ti magnetron power between 5 and 40 nm. In the case of 60 W and more Ti magnetron power, the thickness of amorphous carbon is minimal. Comparing our previous and current results with a semi-empirical equation on the average atomic fraction of Ti showed a good agreement. All the Ti atoms reaching the target surface are bound to TiC during the deposition process.

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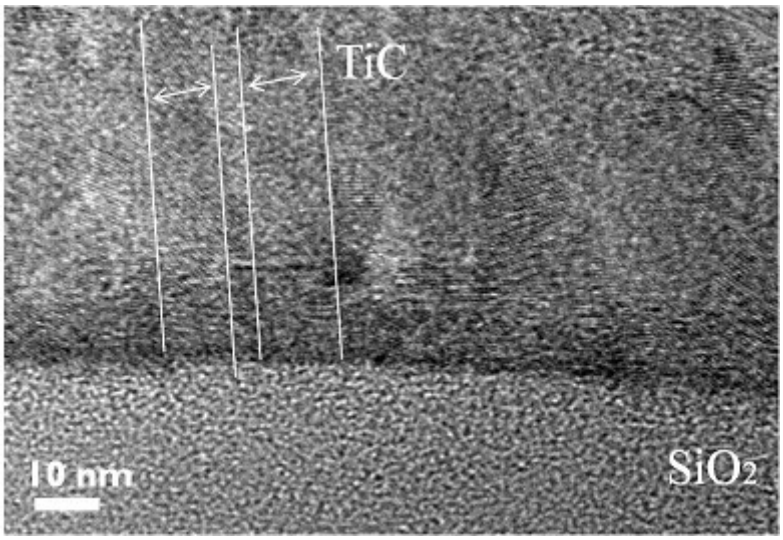

Fig. 1: Figure 1. Cross-sectional HREM image of TiC/ a:C nanocomposite films prepared at 50 W of Ti power.