Adhesion and mechanical properties of implanted nanostructured tungsten

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Owing to its properties: high melting point, low vapor pressure, low physical and chemical sputtering yields, low thermal expansion, electrical conductive properties and relative chemical inertness, tungsten seems to be one of the best candidates to be used as shielding material in plasma facing materials (PFM) for future nuclear fusion reactors. Nowadays, the capabilities of nanostructured materials for such applications are being attracted much attention due to their radiation-resistant and self-healing behavior.

In this work, the capacity of the nanostructured W (nW) as protective role in PFM is studied and the radiation-induced changes in the structure and mechanical properties have been investigated. For this purpose, high density coatings made of nanometric tungsten columns (nW) were prepared by direct current (DC) magnetron sputtering and later were implanted under different conditions: (i) single implanted with H, (ii) sequentially with C and H, and (iii) simultaneously (co-implanted) with C and H at room temperature.

The stress state was analyzed by X-ray diffraction, while the mechanical properties and adhesion to the substrate have been characterized using the nanoindentation and the nanoscratch techniques respectively.