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TaN layers deposited by high power pulsed magnetron sputtering for CNT growth control

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The importance of the substrate-catalyst interface is being recognized as one very promising research way to improve the control of the carbon nanotubes (CNTs) growth. Following the trend, this communication focuses on the role of nanostructure of tantalum nitride TaNx [x=0, 2] thin films acting also as diffusion barrier for iron in the carbon nanotubes (CNT) growth process.
TaNx thin films were deposited on Si (100) substrates by conventional DC magnetron sputtering (MS) or by high power impulse magnetron sputtering (HiPIMS) from tantalum target (100 mm diameter). The nanostructure and composition were tuned adjusting the ratio N_2:Ar into the plasma phase. The films were characterized in terms of surface *versus* bulk stoechiometry (XXPS *vs*. RBS and NRA), crystalline phases (XRD) and roughness (SEM). It is shown that the composition of the films from pure metallic Ta to Ta_3N_5 can be controlled by reactive magnetron process (DC or HiPIMS). On these TaNx films, CNTs were grown by catalytic chemical vapour deposition at 850°C in Ar flow (CCVD), using a continuous feeding with aerosols; composed of toluene (carbon source) and ferrocene (catalyst source). The CNTs were characterized in terms of morphology (SEM), cristalinity (XRD, electron diffraction, Raman spectroscopy) and stoechiometry (XPS at the iron, nitrogen, oxygen and carbon edges). The influence of the nano-structure of the different ultra-fine “buffer layers” on the CNT physical properties are presented and discussed.

Keywords
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