Diamond microchannels fabricated by diamond deposition on superhydrofilic and superhydrophobic VACNTs

Romário Araújo Pinheiro[1,*,#], Amanda Araujo Silva[1], Vladimir Jesus Trava-Airoldi[1], Evaldo José Corat[1]

[1]National Institute for Space Research, São José dos Campos, Brazil

[#]Corresponding author: araujoromario12@yahoo.com.br

The Vertically Aligned Carbon Nanotubes has been applied to fluids control in micrometer and nanometer scale. The microfluidic devices are employed to detect enzymes, proteins and DNA. Diamond is widely recognized for the chemical inertia and physical stability. In this study, we present a new approach in which a microfluidic device was produced by diamond deposition on VACNTs. The catalyst metallic particles were deposited on steel plates by dip-coating method. The VACNTs growth was carried out by thermal CVD method in tubular reactor about 700°C. A flow of argon dragged the camphor vapour into the active zone. Oxygen plasma grafted O_2 polar groups on VACNTs changing their wettability to superhydrophilic. The CO_2 laser was used to irradiate same regions of functionalized samples to remove polar groups and amorphous carbons remained after the CVD process. In addition, this process changed the carbon nanotubes wettability to superhidrophobic. This treatment produced microchannels on samples surface. The Electrostatic Self Assembly (ESA) seeding was made with 4 nm diamond nanoparticles, dispersed in KCl aqueous solution. The diamond films were deposited in a Hot Filament Chemical Vapour Deposition reactor. Morphologic and structural analyses were performed by Raman Spectroscopy, Scanning Electron Microscopy with Field Emission Gun (SEM-FEG), Energy-Dispersive X-Ray Spectroscopy (EDX) and Cyclic Voltammetry (CV). The composite wettability was verified by contact angle (CA) analyses. Diamond film did not signicantly modified the VACNTs wettability. Diamond coating could avoid VACNTs removal from substrate by fluids motion. This new microfluidic device presents high potential to application in water collect and electrochemical analyses.