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Carbon nanotubes and nanowalls on highly-porous alumina

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Vertically-aligned carbon nanotubes and carbon nanowalls are important for many applications such as sensors, optoelectronics, energy and signal conversion devices and others including various biomedical, biosensing and drug delivery systems. Here, a novel plasma-based approach to form the patterns of vertically-aligned carbon nanotubes and few-walled carbon nanowalls on highly-porous membranes of various porosity (pore sizes), bare and covered with thin highly-conductive layers is reported. It is demonstrated that by involving plasma post-treatment of the nanoporous membranes and using additional carbon precursors (such as standard S1813 photoresist) one can control the morphology of the nanotube and nanowall arrays grown on the membrane surface. A few options to control the growth of nanotubes inside the membrane channels and on the upper membrane surface were considered and successfully demonstrated. In particular, the nanotubes can conformally fill the membrane channels and do not form mats on the membrane top. Moreover, a plausible mechanism of the nanotube nucleation and growth inside of the membrane channels is proposed based on the estimated depth of ion flux penetration into the channels. The experiments show that denser arrays of nanotubes can be formed due to the plasma treatment, and importantly, the upper surface of the membrane can be kept free of nanotubes confined inside the membrane channels. Further experiments with different types of plasmas are warranted to reveal the potential of this method for applications of organic-inorganic nano-hybrid materials for energy storage, sensing, and other emerging areas.

Biography

I Levchenko is a Commonwealth Scientific-Industrial Research Organisation (CSIRO) Senior Research Scientist and Team Leader of the Plasma Nanoscience group. His bibliography includes more than 100 scientific papers published in the reputed international journals. His scientific research interests include material science, plasma technologies including nanotechnology, nanofabrication, nano-structures and their applications.

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