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Vertically-aligned carbon nanowalls on nanoporous membranes

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Carbon nanowalls and vertically-aligned graphene flakes are among the most promising two-dimensional materials potentially useful for many important applications such as optoelectronics, nanoelectronics, sensing, energy and signal conversion, and many other devices. We describe the fabrication of vertically-aligned carbon nanowalls of various morphologies on the nanoporous membranes treated with ions in solutions, as well as coated with thin metal layers and activated in the low-temperature plasmas. We demonstrate that various combinations of the nanowall thicknesses and defect levels can be obtained, and the morphology of the nanowall pattern can be effectively controlled. Specifically, we report on a novel inductively-coupled plasma (ICP) based approach to grow the networks of vertically-aligned few-walled carbon nanowalls on nanoporous alumina (Al_2O_3) membranes. To effectively control the morphology, thickness and level of the structural defects of the carbon nanowall networks, various methods of post-treatment were used including noble-gas plasma and solution-based treatments with various ions (Co+, Pd+, Au+). Also, a continuous gold film was applied onto substrates to control the network morphology. The results of our experiments demonstrate a strong dependence of the carbon nanowalls network morphology on the post-treatment technique. The work could be of interest for various applications requiring fabrication of large graphene networks with controllable properties.

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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Semiconductor microstructure optical resonators

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Semiconductor microstructure optical resonators have attracted much attention due to their microscopic size, high quality factor Q, and low lasing threshold power. In a semiconductor optical resonator, the microstructure itself functions as both the gain medium and the optical microcavity. The morphology and size of the microcavity could greatly affect the energies and the type of the resonant modes. ZnO (3.37 eV) and In_2O_T (3.25 eV) are two important semicontor oxide materials for optoelectronic applicaitons in the UV and visible spectrial range and widely studied in recent years. We report our studies on the fabrication and optical properties of novel ZnO and In2O3 microcavities with different morphologies. The samples were fabricated by using simply chemical or physical vapor deposition method. For the optical properties, we investigated the PL of the microcavities by using a spatially resolved spectroscopic technique. The morphologies, crysalline nature, optcial modulations and UV lasing of the as-synthesized microcavities were investigated in detail. We found that such microstructure microcavities can effectively control the light filed in low dimensions. The research opens up opportunities to develop novel optical caivity based devices in an efficient way.

Biography

Hongxing Dong is an Associate Professor of Shanghai Institute of Optics and Fine Mechanics. He received his PhD degree from Fudan University in 2011. His research interests focus on the fields of optical micro/nanostructures. He has published more than 30 papers in peer-refereeing international journals, such as PRL, JMC, JPCC, etc..

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