

Diamond based Micro and Nano Systems

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Abstract

The synthesis of nanodiamond (including nanocrystalline and ultrananocrystalline diamond) thin films and their properties have been studied extensively and various properties are now well established indicating nanodiamond films as promising candidate materials for the fabrication of high performance, long endurance micro/nanoelectromechanical systems (MEMS/NEMS) [1]. However, residual stress is continued to be the main hurdle restricting the use of nanodiamond films in the fabrication of sophisticated MEMS/NEMS. In the first part of my talk, I will discuss some of the recent results on the fabrication of MEMS devices based on nitrogen incorporated ultrananocrystalline diamond (N-UNCD) films and various strategies to reduce the residual stress. We demonstrate fabrication of a moving MEMS device in N-UNCD with a linear displacement from 10 nm to 500 nm (work done in collaboration with University of TU Delft). In the second part of my talk, I will discuss fabrication of NEMS devices based on nitrogen incorporated UNCD and boron doped UNCD nanowires. Our previous work has already demonstrated fabrication of UNCD nanowires with widths in the range of 20-150 nm using the top-down fabrication process [2]. I will discuss the progress in the fabrication of a nanowire based NEMS switch as well as possibility of fabricating precision displacement sensors based on UNCD nanowires. We believe that these results will open-up new opportunities for the fabrication of NEMS devices and sensors with increased sensitivity and new functionalities for a variety of applications.

Keywords: Ultrananocrystalline diamond, nanowire, nanowitch

References:

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2. X. Wang et al. Nanotechnology, 23, 075301 (2012).

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