Nanocrystalline Diamond Thin Films for MEMS and Biomedical Devices

NSF NIRT Grant 0404137
PIs: Ashok Kumar, S. Bhansali, I.I. Oleynik, T.M. Weller;
University of South Florida, Tampa, FL

Highlights:

The primary objective of this project is to synthesize and characterize the nanocrystalline diamond (NCD) films for building the microelectromechanical systems (MEMS) and biomedical devices as they allow designing the complex mechanical elements with micrometer feature sizes by tailored material properties at the nanoscale to achieve the highest performance. The synthesis is achieved by Microwave Plasma Enhanced Chemical Vapor Deposition (MPECVD) and the microstructural properties are characterized by scanning electron microscopy (SEM), Transmission electron microscopy ((TEM), Fig.1) and micro Raman studies (see Fig.2). TEM results have shown that the grain sizes are in the order of 10-15 nm while the micro Raman shows a shift at 1332 cm^{-1} indicating the signature of diamond.

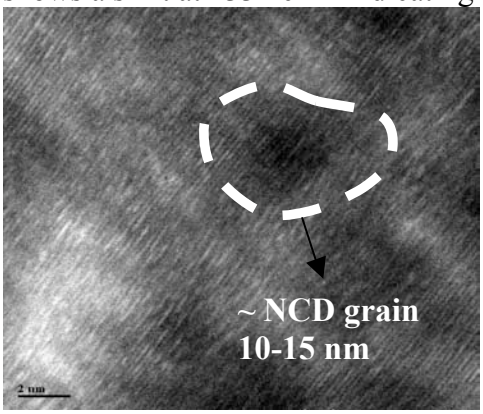

Fig.1

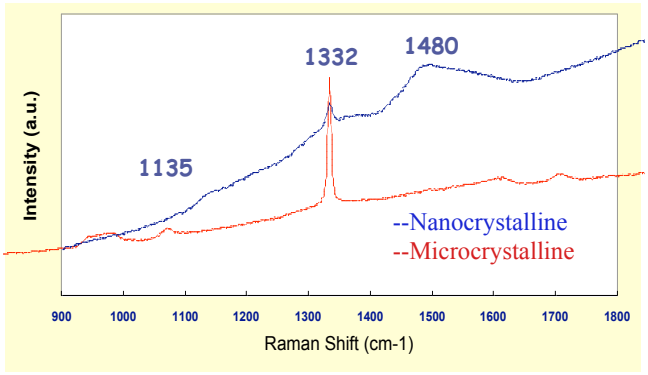

Fig.2

The synthesis of a composite material with NCD and ZnO nanowires is currently being studied. The preliminary investigation has shown that there is a very well intercalation between the grains of NCD and ZnO nanowires. Fig.3 (a) shows a HR-TEM image of a ZnO nanowire with NCD grains. The electron diffraction pattern with diamond (111) and (220) planes is shown in Fig 3(b). SEM image shows the super grains with nanaowires (see fig. 3(c)). A further study on this nanocomposite might be useful for novel applications in MEMS actuators.

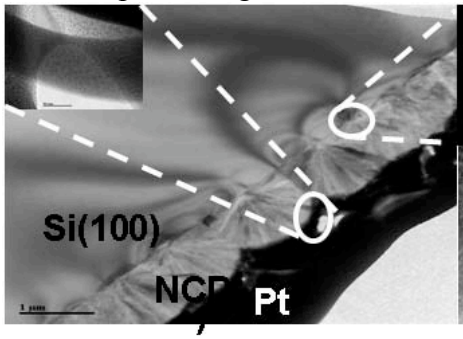

Fig.3(a)

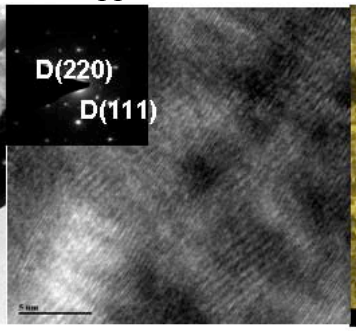

Fig.3(b)

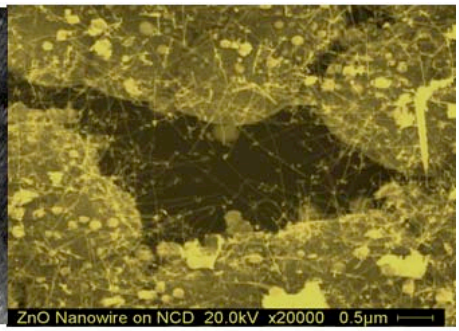

Fig.3(c)

Reference:

For further information about this project, please contact Dr. Ashok Kumar.
E-mail: akumar@eng.usf.edu