The Effects Of Various Si Substrates On The Field Emission Of Cubic Boron Nitride Thin Films

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Field emission results from an on-going study of thin films of polycrystalline cubic boron nitride (cBN) are presented. Samples under study have been synthesized using the reduced-bias ion-assisted sputtering technique [1], which enables the growth of 100% cubic phase up to 2μm in thickness. cBN films grown by this technique have been shown to exhibit an (100) out-of-plane texture [2], which differs from that of cubic boron nitride films grown using other techniques [3,4,5]. Various substrates have been utilized for this experiment: Si(100), etched polysilicon, and Si nanotip field emitter arrays. Reflection High Energy Electron Diffraction (RHEED) was used to characterize the surface morphology of the deposited films *in situ*; Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM) data of the BN thin films were obtained outside the growth environment. Fourier Transform Infrared Spectroscopy (FTIR) provided crystal phase and composition information of the boron nitride films, with the high intensity peak corresponding to the cubic BN zone center TO phonon absorption, typical of the tetrahedral sp^3 bonding of the cubic zinc-blende structure, being observed. The field emission of the BN films grown on the different substrates was examined, using a customized parallel plate configuration at pressures of 10^{-8} Torr or lower. Conclusions based on the analysis of these emission results are offered with particular regard to the effects of the different morphology and structure of the substrates, which consequently provides insight into the field emission characteristics of the cBN thin film itself.

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