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Spectroscopic phonon and extended x-ray absorption fine structure measurements on 3C-SiC/Si (001) epifilms

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Comprehensive experimental and theoretical studies are reported to assess the vibrational and structural properties of 3C-SiC/Si (001) epilayers grown by chemical vapor deposition in a vertical reactor configuration. While the phonon features are evaluated using high resolution infrared reflectance (IRR) and Raman scattering spectroscopy (RSS) the local inter-atomic structure is appraised by synchrotron radiation extended x-ray absorption fine structure (SR-EXAFS) method. Unlike others, our RSS results in the near backscattering geometry revealed markedly indistinctive longitudinal and transverse-optical phonons in 3C-SiC epifilms of thickness d<0.4 μm. The estimated average value of biaxial stress was found to be an order of magnitude smaller while the strains were two-orders of magnitude lower than the lattice misfits between 3C-SiC and Si bulk crystals. Bruggeman's effective medium theory was utilized to explain the observed atypical IRR spectra in 3C-SiC/Si (001) epifilms. High density intrinsic defects present in films and/or epilayer/substrate interface were likely to be responsible for (a) releasing misfit stress/strains, (b) triggering a typical features in IRR spectra and (c) affecting observed local structural traits in SR-EXAFS.

Biography

Devki N Talwar graduated from Allahabad University in India in 1976 with a PhD degree in Condensed Matter Physics. From 1977-80 he worked as a Visiting Scientist at the Commissariat a'l Energie Atomic, Saclay, Gif-sur-Yvette, France with M Vandevyver. While at Saclay he collaborated with theoretical /experimental group of M Balkanski, including Karel Kunc, M Zigone and G Martinez and supervised three PhD theses. In January 1980 he joined the Physics Department, University of Houston as a Visiting Professor and collaborated with P C S Ting on problems related to the electronic properties of defects in semiconductors and supervised a PhD student. From 1982-87 he was a Faculty at Texas A & M University. He joined the Physics Department at Indiana University of Pennsylvania in 1987, supervised 20 MS theses. Since 2007-2014, he has served as the Chairperson of the Physics Department.

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