The asymmetry of planar defect density in 3C-SiC grown on disoriented silicon substrates

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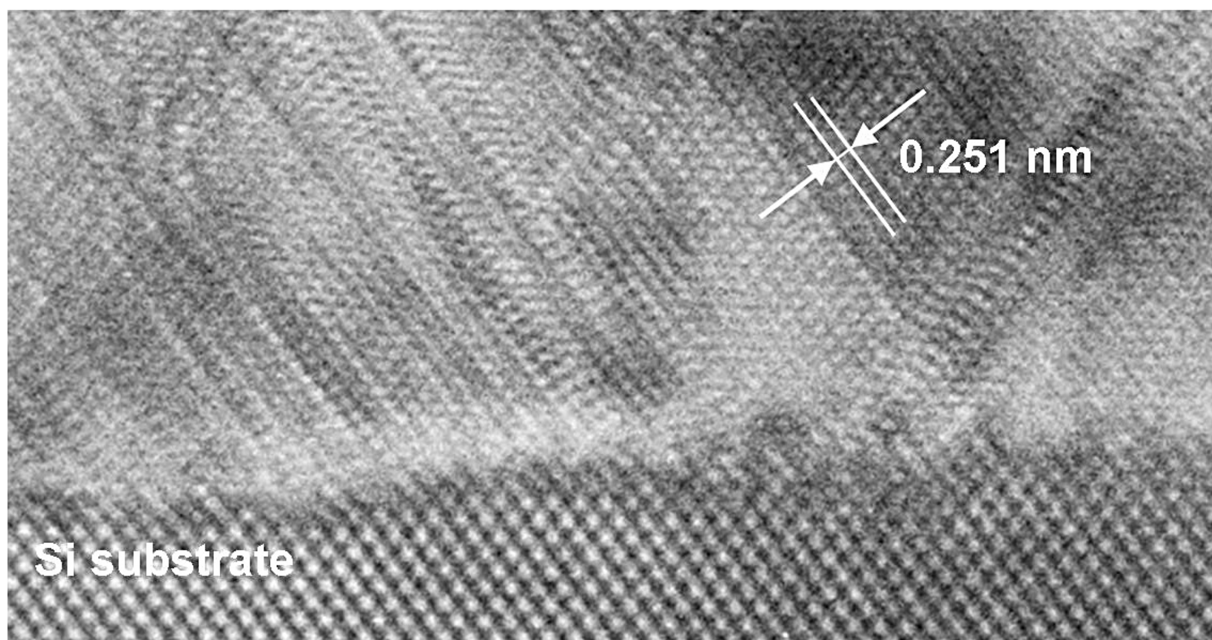
Cubic silicon carbide grown on silicon is considered as a potential candidate for the development of power devices. The lattice mismatch between the Si and 3C-SiC is of about 20%. Successful growth of useful 3C-SiC layers on silicon substrate is achieved. The different strain engineering strategies allowed the reduction of defect density in the top part of the layer. One of the approaches tested in the purse of reduction of the planar defect density is the growth of SiC on the disoriented silicon substrates. An asymmetric defect structure related to the miscut for (001) oriented substrates has been reported by Nagasawa et al. We present a detailed TEM study of this asymmetry. We show how the structure of the nucleation layer changes in the function of the disorientation of the substrate wafer. Our investigation shows that the structure of the SiC interface region influences the final defect density. The diffraction contrast in bright and dark field in plan view TEM and cross-sectional TEM was used to evaluate the nature and density of planar defects. Structural analysis of the interface region was performed using the Moiré pattern formed on highly inclined interface. The geometric phase analysis GPA of the HRTEM images of the interface region was used to understand the defect interaction in this highly stressed part of sample.



HRTEM image of 3C-SiC layer grown on Si (100) 6°off substrate taken along the miscut axis.