HRTEM STUDY OF SIC BURIED LAYER FORMED BY C^+ IMPLANTATION IN SILICON

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Abstracts:
The structure of p-silicon implanted with 120keV and 160keV carbon ions at target temperature 700℃ and subsequent thermal annealing is studied by high-resolution transmission electron microscopy (HRTEM). Epitaxial, buried silicon carbide (SiC) layers are revealed by translation-type (111) Moiré fringe and electron diffraction at SiC/Si interface. In addition, plenty of β-SiC precipitates free of strain with a diameter of about 5nm embed in Si matrix. Several poly-type SiC exist in SiC/Si transition zone, also present in Moiré fringes with Si. Regular Moiré fringes show good alignment between SiC and the matrix.

Heavily defected single-crystal silicon overlayer is near SiC buried layer, while the upper part is nearly free of any defects. The SiC/Sub Si interface is relatively smoother than top Si/SiC interface. The main defects in buried layer are stacking dislocations, crystal boundary, microtwins, and amorphous clusters. The segments of dislocations are almost along <111> orientation. In SiC/Si transition zone, Si crystal lattice distortion occurs for 20% mismatch between SiC and Si. Implantation damage also causes Si amorphism. Besides hexagonal coherent precipitates, many irregular Moiré patterns with spherical boundary present in Si bulk. The mechanism of all defects formation is discussed at the end.