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**Topographic and reflectometric investigation of 4H silicon carbide epitaxial layer deposited at various growth rates**

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4H silicon carbide substrates of good crystallographic perfection and off-cut of $8^o$, $4^o$ and $0^o$ were systematically investigated with conventional and synchrotron X-ray diffraction topography and X-ray reflectometry before and after the epitaxial deposition performed at $1560^oC$ with CVD method. The samples were grown with three different growth rates 2, 6 and 12 mm/min and the middle of these values was chosen to be most widely used in other technological manufacturing of SiC layers. The layers were not intentionally doped, while the concentration of substitutional aluminum atoms in the n type substrates was at the level of $10^{18}$ $cm^{-3}$.

The defect structure was carefully studied before and after the epiataxial layer growth with a number of X-ray methods including white beam and monochromatic beam topography. The white beam topographic investigations were performed both in transmission and back-reflection geometry. In order to examine the dislocations in larger area we applied the conventional transmission Lang topography using Mo $Ka_1$ radiation. The topographic methods enabled the identification of the most of defects present in the sample using both the extinction analysis and the simulation of the diffraction images.

The topographic investigations performed after the deposition of the epitaxial layers in the samples with $8^o$ and $4^o$ off-cut confirmed the continuation of the dislocations in the epitaxial deposit. We did not observe any formation of new dislocations and any other extended defects in the epitaxial all three growth rates.

Contrary to that we found a distinct difference of the surface roughness of the layers deposited at different growth rates: the difference is found to increase with increasing applied growth rate.

The presently applied conditions were not suitable to obtain the single polytype 4H-SiC epitaxial deposit for the substrates with $0^o$ off-cut, and the obtained layer contained a large amount of differently distributed other polytypes, especially the 3C one. An interesting phenomenon was observed in the case of the layer deposited at 12 mm/min growth rate, when the 3C polytype formed islands of relatively large dimensions reaching single hundreds of microns or even single millimeters. These islands contained several misfit dislocations and other new created defects.

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