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Doping and stability of 3C-SiC: from thinfilm to bulk growth

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Cubic silicon carbide (3C-SiC) could pave the way for development of advanced electronic and optoelectronic devices. It could be an excellent substrate for growth of nitride and epitaxial graphene layers. Boron doped 3C-SiC films could reach up to 60% efficiency and pave the way for a new solar cell technology. Nitrogen and boron doped 3C-SiC layers can depict a new infrared LED.

Hexagonal SiC is an excellent substrate for heteroepitaxial growth of 3C-SiC due to excellent compatibility in lattice constant and thermal expansion coefficient. However, the growth of 3C-SiC on such substrates is still being followed by a number of obstacles like polytype stabilization and high density of double positioning boundaries in the grown material. The polytype stability during epitaxial growth of doped 3C-SiC has not been explored. Consequently, the polytype stability during bulk growth of doped 3C-SiC is not known.

In this study we explore the growth of low and medium doped bulk-like 3C-SiC layers on off-oriented 6H-SiC substrates using a sublimation epitaxy technique. We compare SIMS, XRD and PL data obtained from 3C-SiC material grown using polycrystalline SiC sources prepared by CVD with a low ($\sim 10^{16}\text{cm}^{-3}$) boron concentration and by PVT with a medium ($\sim 10^{18}\text{cm}^{-3}$) nitrogen and boron concentrations. The effects of impurities on polytype stability and crystal quality of low and medium doped bulk-like 3C-SiC layers with thickness up to 0.5 mm are analysed. Moreover, the remaining challenges in growth of 3C-SiC for optoelectronic applications are discussed.