Improvement of SiC single crystal by a novel method

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Recently, the wide bandgap semiconductors, especially silicon carbide (SiC), have become an ideal substrate for high critical electric field and high thermal conductivity due to the excellent physical properties, such as wide band gap, high critical electric field and high thermal conductivity [1,2]. At now, with the rapid development of SiC single crystal grown by physical vapor transport (PVT) method, SiC crystals of 6-inch and 8-inch have been prepared and deployed in large-scale commercial applications. However, SiC substrate by PVT method still faces great challenges in cost reduction and quality improvement. One of the outstanding problems to be solved urgently is that micropipes and hexagonal cavities defects caused by the seed crystal reverse sublimation. In order to suppress the occurrence of this process, the approaching of seed crystal bonding was usually adopted [3]. Unfortunately, the way of seed crystal bonding has great uncertainty and cannot completely prevent seed crystal reverse sublimation, due to the crystal growth at high temperature. Therefore, we propose a novel method to alleviate the problem of reverse sublimation.

In this study, the reverse sublimation of the seed crystal is suppressed effectively by adding silicon powder to the back of seed crystal, due to formation of the Si-rich atmosphere. The effect of ratio of Si/glue content on the reverse sublimation are systematically investigated, and the results show that the reverse sublimation of seed crystals is suppressed effectively, resulting in lower hexagonal cavity defects at the initial stage of crystal growth, as the ratio is 1:0.95. Based on this technology, the 6-inch SiC crystals with zero micropipes and low defects are successfully grown in our lab.

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