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Defect Evaluation of high-quality SiC grown by solution method

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1. Introduction

Sillicon carbide (SiC) is expected to be a promising material for the next-generation high-breakdown and low-loss power devices due to its remarkable physical properties such as wide band gap and high-breakdown electric field. In order to realize the theoretically predicted potential of SiC for power devices, the reduction of defects in crystal wafers such as threading screw dislocation (TSD), threading edge dislocation (TED), and basal plane dislocation (BPD) is extremely crucial. Solution growth method is a promising approach to produce low-dislocation-density SiC crystals because that threading dislocations could be converted to basal plane dislocations during the solution growth process, which demonstrates that high quality can be achieved.

2. Experiment and method

SiC crystal growth experiments were conducted by the TSSG (Top-Seeded Solution Growth) method. In order to characterize the dislocations in the crystals, Synchrotron X-ray topography was carried out.

3. Results and discussion

Figure 1 shows a topographic image taken from 11-28 direction of a 3inch N-type SiC crystal. Several spiral growth centers can be observed in fig. 1 a). The white arrows indicate TSD, there are two spiral growth mechanisms, one is cooperating spirals which contains two spirals, the others are non-cooperating spirals. And the white curve indicates boundary where great amount of BPDs locate in, that means decreasing the number of spiral center can suppress new generated BPDs. Fig. 1 b) shows a set of parallel BPDs which indicated by white curve. The size of the BPDs are bigger than the other BPDs, the formation mechanism will continue to be studied in the future.

a) spiral growth　　b) BPD

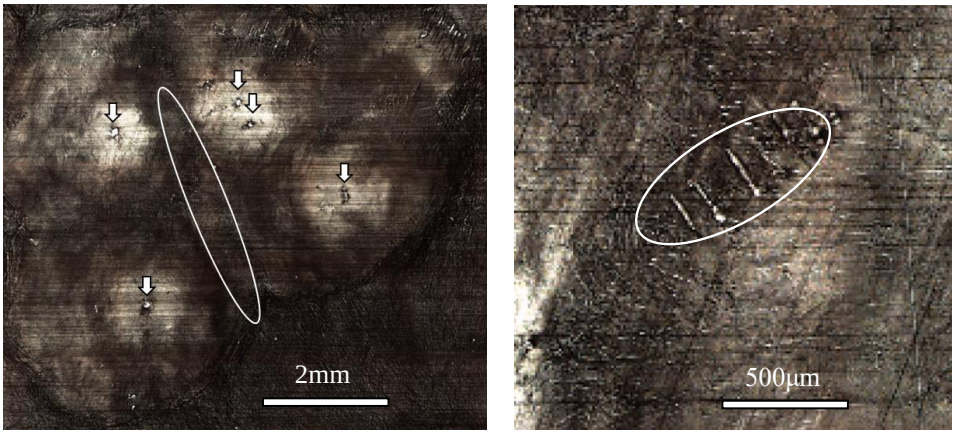

Fig.1 X-ray topographic image of N-type SiC crystal