SiC 溶液成長過程における基底面転位の形成
Investigation of basal plane dislocations generated during solution growth of silicon carbide

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Introduction: Basal plane dislocations (BPDs) have been reported as a primary source of the stacking faults (SFs) which lead to the degradation of the forward voltage drop of the device [1]. During solution growth, the BPDs in SiC epilayers are primarily propagated from the substrates and converted from TEDs. As the growth proceeds, these BPDs can be excluded [2]. However, further observation experimentally suggests the generation of BPDs throughout solution growth which hampers the reduction of BPDs. Therefore, a comprehensive understanding of such BPDs is necessary. In this study, the BPDs generated throughout solution growth were investigated.

Experimental: SiC crystals were grown by top-seeded solution growth method. [1120] off-oriented 4H-SiC (0001) were used as seed crystals. The growth were conducted at 1700°C for 10 min, 30 min and 1 hour respectively. Grazing incidence reflection X-ray topography was performed to image the dislocation in substrates and epilayers.

Results and Discussion: Fig. 1 shows X-ray topographic images of Si-face off-axis 4H-SiC (0001) (a) seed crystal, (b) epilayer at the same position for 1 h growth. Two dendritic contrasts (marked A1 and A2) are observed in (b) comparing the identical position without any contrasts in (a). Furthermore, in topography image linear contrasts correspond to BPDs [3]. Thus, newly generated BPDs along the step flow direction (Fig. 1, white arrows) are confirmed to appear after the epitaxial growth. The depth where they generated can be calculated from contrast length. Hence we may obtain the generation depth of A1 and A2 are 4.68 μm and 10.82 μm under epilayer surface respectively. In addition the densities of such newly generated BPDs for 10 min, 30 min and 1 hour growth are summarized in Table 1. According to Table 1, the density of newly generated BPDs increased slightly with the growth time.

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Table 1. The time dependence of newly generated BPDs

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<tr>
<th>Growth Time(min)</th>
<th>The density of newly generated BPDs(per cm²)</th>
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<tr>
<td>10</td>
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