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The effect of Al doping on surface energy according to Si- and C-face in the growth of SiC by TSSG

김대성[1], 신윤지[2], 정성민[2], 유영재[2], 강준혁[1], 박미선[1], 장연숙[1], 이원재[1a]
Dae Sung Kim[1], Yun Ji Shin[2], Seong Min Jeong[2], Yeong Jae Yu[2], June Hyuk Kang[1], Mi Seon Park[1], Yeon Suk Jang[1], Won Jae Lee[1a]

[1]동의대학교
[2]한국세라믹기술원

Abstract:

SiC(Silicon Carbide) is a promising substrate applicable to power device working at high power, high frequency and high temperature. It has excellent physical properties including wide band gap, thermodynamic stability at high temperature, high electron mobility and good thermal conductivity.

So far, physical vapor transport (PVT) has been assumed to be the most efficient method growing commercialized large scale SiC crystals. However, crystal defects such as threading edge dislocations (TEDs), basal plane dislocation (BPDs) and threading screw dislocation (TSDs) are still issues in the SiC wafers obtained via PVT method because they influence on the failure and the degradation of SiC power devices. Currently, solution growth has been actively studied as an alternative method growing high quality SiC crystal because the crystal growth via the solution growth could be achieved under a close condition to thermodynamic equilibrium state.

In this study, the surface energy of the crystals grown on different growth face (Si face, C face) was investigated in solution growth of 6H-SiC. Since. The experiment was carried out by attaching two seeds to one shaft for the same experiment conditions. TSSG (The top-seeded solution growth) method was performed for growing SiC crystal. By measuring the contact angle of the water droplet on the surface, the relative surface energy difference can be known. Al doping concentration was detected by SIMS and the relation between surface energy of each crystallographic plane and Al-doping can be known. It was confirmed that the terrace length of step according to the grown crystal plane was different by optical microscopy and step height and shape was measured by using surface profiler.

Keywords

TSSG, SiC, surface energy, Al doping, growth face

a. 교신저자 이메일

leewj@deu.ac.kr