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Residual stress originated from the solidified Si droplet on surface of SiC crystal grown by TSSG method

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Abstract:

Silicon carbide (SiC) is a wide bandgap material which is a potential substrate material for high power and high frequency devices and applications. Top seeded solution growth (TSSG) method is distinguished as a superior method to grow high quality SiC single crystals. C-dissolved Si-rich melt is the source of SiC crystal grown by TSSG method. After withdrawal of the SiC crystal from the melt, liquid droplet is occasionally remained on the surface of the SiC crystal. As solidifying the liquid droplet after crystal growth, the droplet residue invokes residual stress on the surface of the SiC crystal by the mismatch of the thermal expansion coefficient between SiC and Si. The residual stress results in numerous defects such as micropipes, dislocations, and fracture origins during wafering process. In this study, finite element analysis was done to understand the formation and solidification of the droplet, and the residual stress on the crystal surface. The simulation approach provided a new insight on annealing process to remove the residual stress is necessary.

Keywords

SiC, TSSG, Residual stress, Droplet, Simulation

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