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Unveiling Polytype Transformation Assisted Growth Mechanism in Boron Carbide Nanowires

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Abstract

We demonstrate direct evidence that the lattice distortion, induced by boron carbide (B_xC_y) stoichiometry, assists the growth of boron carbide nanowires. The transformation between different polytypic boron carbide phases lowers the energy barrier for boron diffusion, promoting boron migration in the nanowire growth. An atomistic mass transport model has been established to explain such volume-diffusion-induced nanowire growth which cannot be explained by the conventional surface diffusion model alone. These findings significantly advance our understanding of nanowire growth processes and mass transport mechanisms and provide new guidelines for the design of nanowire-structured devices.

Keywords: Boron carbide nanowire, Growth mechanism, volumetric diffusion model, diffusion energy barrier

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