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# SiC 溶液成長において流速の変化が表面モフォロジーに与える影響
# The effect of the solution flow velocity on the surface morphology in the solution growth of SiC

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**Introduction:** Solution growth is one of the promising methods to achieve high quality SiC crystals. In the solution growth, defect densities, such as threading dislocations (TDs), are largely reduced in the step-flow mode [1]. However, other defects like inclusion is often formed after long time growth, which make the morphology rough and degrade the crystal quality seriously [2]. In our previous studies, we proposed a model for stable step-flow growth by controlling solution flow direction. In this study, we investigate the effect of solution flow velocity on the surface morphology.

**Experimental method:** Growth experiments were conducted by top seeded solution growth (TSSG) method. $[11\bar{2}0]$ $1^{o}$ off-oriented 4H-SiC was used as the seed crystal. Unlike conventional TSSG method, the seeds were deviated from the center of the crucible. By rotating the crucible, one way flow (step-up flow or step-down flow) on the seeds was achieved as shown in Figure 1. Different solution flow velocity was obtained by controlling the crucible rotation speed. The solution flow velocity ranges from 0 cm/s to 15.7 cm/s. Surface morphology and roughness were characterized by atomic force microscopy (AFM).

**Results & Discussion:** The dependence of surface roughness (RMS) on solution flow velocity was shown in Figure 2. With step-up flow, the RMS ranges from 60 to 80 nm, which indicates that the roughness is independent on solution flow velocity in the step-up flow case. However, with step-down flow, the roughness changes with solution flow velocity. Under the flow velocity of 0, 6.3 and 15.7 cm/s, the RMS was at the same level. And the RMS increases with the solution flow velocity of 3.2 cm/s and 8.6 cm/s. The largest roughness was obtained under the solution flow velocity of 8.6 cm/s. This indicates that the surface morphology is not only influenced by solution flow direction, but also solution flow velocity.

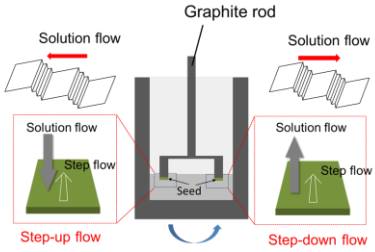


Figure 1. Schematic illustration of growth system.

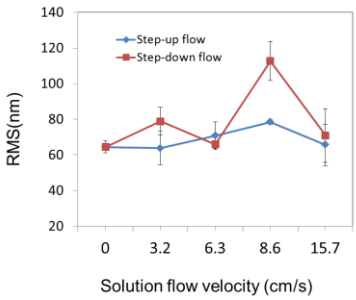


Figure 2. The dependence of surface roughness on solution flow velocity.

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