

FZ シリコン結晶成長における 3 次元熱伝導モデル

3D global heat transfer model on floating zone (FZ) for silicon crystal growth

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Floating zone method is one of the best methods to grow single crystal silicon with high purity. The quality of single crystal silicon strongly depends on the temperature distribution during the growth process. In previous studies, 2D axis-symmetrical global models have been developed to investigate the heat transfer in floating zone silicon [1, 2]. However, to increase the homogeneity of dopant distribution, the feed rod is not co-axial with crystal. Additionally, the induction heater is not axis-symmetrical. Therefore, in present study, a 3D global heat transfer model has been developed, which is coupled with 3D EM model. Through the quasi-steady calculation in 3D model, heat transfer, melt flow and gas flow in have been obtained. The temperature distribution and gas velocity vector distribution are shown in Fig. 1 and Fig. 2.

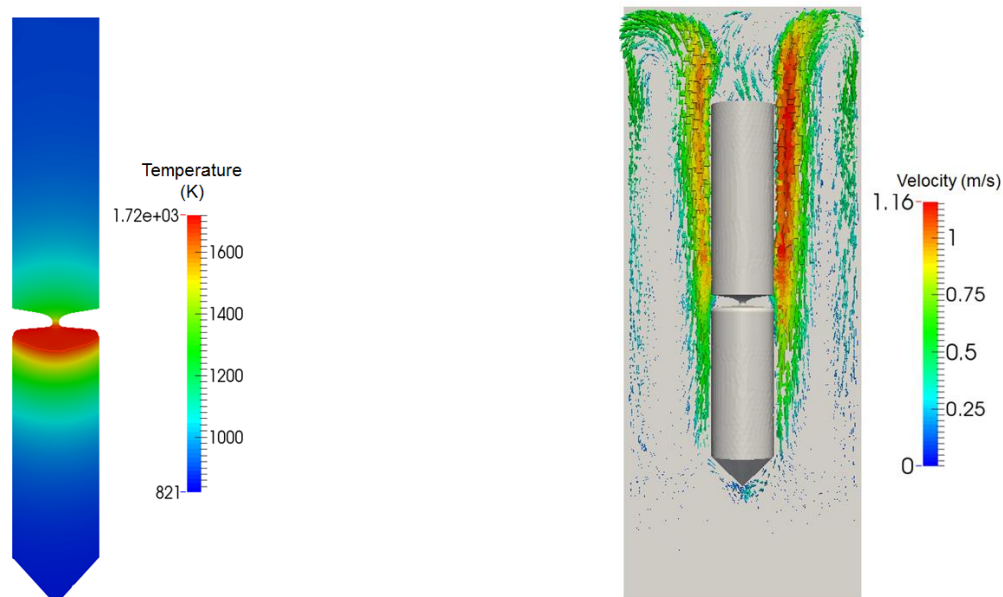


Fig. 1 Temperature distribution in the feed rod and crystal. Fig. 2 Flow velocity vector distribution in gas.

- [1] A. Sabanskis, J. Virbulis, Simulation of the influence of gas flow on melt convection and phase boundaries FZ silicon single crystal growth, *Journal of Crystal Growth*, 417 (2015) 51-57.
- [2] K. Surovovs, A. Muiznieks, A. Sabanskis, J. Virbulis, Hydrodynamical aspects of the floating zone silicon crystal growth process, *Journal of Crystal Growth*, 401 (2014) 120-123.

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