

Global Heat Transfer Analysis for Heat Exchanger Method in Growing Sapphire Single Crystals

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Sapphire single crystals are widely used in a variety of modern high-tech applications, from commercial and military optical systems to high power laser components, and semi-conductor substrates because of the combination of desirable optical and mechanical properties. Large Sapphire crystals can be grown by various techniques including the heat exchanger method (HEM), gradient solidification process and edge-defined film-fed growth. The HEM is a process which controls both the heat input and the heat extraction independently in a crystal growth furnace.

Transient numerical analysis for the HEM process in growing sapphire crystals was performed to study the heat transfer including conduction, convection, and radiation mechanism using commercial software, Fluent. The computer simulation described here is effective to solving the heat transport phenomena. In this work, the computer simulation for the growth of sapphire crystals using HEM process was performed to study the global heat transfer in HEM furnace.