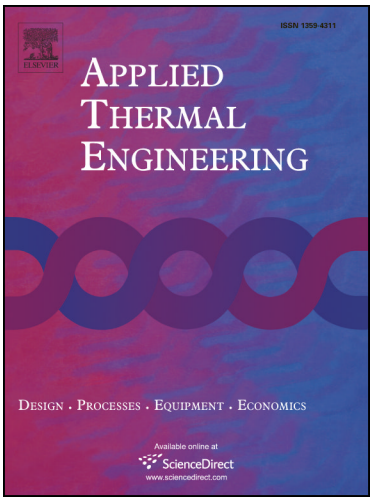

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Abstract

Quartz glass is widely used in modern technologies due to its excellent thermophysical and optical properties. To reduce hydroxyl concentration, a critical impurity affecting optical performance and service life of the glass products, traditional synthesis process of the quartz glass is improved by melting the prepared porous silica ingot in a vacuumed furnace. Since the molten quartz encloses the porous silica ingot, and blocks escape of the gases, originated from hydroxyl or other impurities, the melting pattern should be optimally designed by controlling the operating conditions. In the paper, an integrated model has been developed to study the dynamic melting process of the porous silica ingot, considering heat transfer and large surface deformation. Influences of the heater temperature, the ingot size, the furnace cooling and the crucible design on the melting process are investigated carefully. Based on the analysis, an optimized crucible design with partial sidewall cooling of the furnace is proposed to obtain the preferred melting pattern for enhancing hydroxyl removal.

Keywords: quartz glass, optical performance, phase transition, hydroxyl, optimization

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