Abstract

Directional solidification experiments were carried out in a Bridgman furnace to remove carbon and metallic impurities from silicon. For carbon removal, solidification was achieved by extracting the mold from the hot into the cold zone of the furnace, while for the removal of metallic impurities, solidification occurred by cooling the furnace with a motionless mold. In the experiments of carbon removal, a mold extraction rate of 5 m/s results in an ingot with columnar grain structure aligned in the ingot axial direction and a macrosegregation of carbon and SiC particles to the ingot top regions. However, at a mold extraction rate of 80 m/s, the grain structure consisted of columnar grains aligned in the radial direction and SiC particles were observed throughout the ingot, showing lower macrosegregation with a carbon concentration still larger at the ingot top. In the metallic impurities removal experiment, an ingot with a columnar grain structure aligned in the ingot axial direction was obtained and the concentration profiles showed significant metallic impurities macrosegregation to the ingot top.

Keywords

Silicon refining, directional solidification, macrosegregation.