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**Removal of metal impurities in metallurgical grade silicon by cold crucible  
continuous melting and directional solidification**

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**Abstract**

Cold crucible continuous melting and directional solidification (CCDS) was used to refine metallurgical grade silicon (MG-Si). The metal impurities concentrations, their spatial distributions and the purification effect were investigated and the removal mechanisms of these impurities were discussed. The results indicate that, along the ingot growth direction, metal impurities are mainly accumulated in the ingot top, and the accumulative degree is much higher for nickel (Ni) and relatively lower for calcium (Ca) and aluminum (Al). Along horizontal direction, in accordance with the microstructure, the metal impurities concentrations in the outer area are lower than that in the inner area. In the ingot bottom part, the removal ratios of all the metal impurities reach above 95%. Besides segregation, element evaporation and diffusion also affect the metal impurities redistribution behaviors. CCDS has shown to be a novel process to refine MG-Si with low crucible contamination and consumption, high metal impurity removal ratio, high production yield and purification efficiency.

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