Investigatethe Influence of BoronRemovalby Multi-Fluxes Addition in Metallurgical Grade Silicon

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ABSTRACT

The main purpose of refining the solar-grade poly-silicon studies are following the direction of cost down, reducing air pollution and energy consumption. Therefore, this research adopted the process of oxide fluxes with low cost and low pollution, to eliminate the boron impurities from metallurgical grade silicon. This research program will formulate different types of multi-fluxes and process with Induction Heating Method for slag smelting, then, analyze the content of boron impurity from silicon ingots. Therefore, we can figure out the relations between the types and quantity of fluxes, isothermal holding time, instalment adding times, and the residual boron impurity. From experimental results shown that the calcium oxide will decompose easily and provide more oxygen than alumina, and the oxygen will react with boron to form the boron oxides floating on silicon liquid and separated it. During the smelting of refining, increase the quantity of flux and the holding time, do benefit the decomposed oxygen reacted with boron to form oxides and help to remove the boron impurity. Also increasing the instalment adding times, it also helps the boron impurity continuing removal. If add whole quantity of flux at a time, will not be able to adequate and effective reacting with silicon liquid. However, further increasing the number of adding times, the removal ratio of boron impurity still having a certain limit. If wish to further reduce the boron content, the amount of flux added is required to achieve the goal of low-boron content poly-silicon. Based on the overall experimental results suggested that the best combination of multi-fluxes is 5SiO2-4CaO-1Al2O3, and using 120 wt.% flux divided into five times ’ addition, with 10~15 minutes smelting holding time, should have the most significant results of boron impurity removal in this metallurgical grade silicon. Boron content can be reduced from 8.4 ppm. to 1.7 ppm., the removal rate reached up to 79%.

Keywords : Metallurgical grade silicon、 Multi-Fluxes、 Boron impurity、 Refining

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