To Study the Effect of Physical Metallurgy Processes for Natural Quartz Refining

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ABSTRACT

This research is aimed at the internal impurities removal of nature quartz from different areas. According to the forming conditions are not alike, the ingredients, distribution, and content of metal impurities are also different. If one can use a simple process to purify the quartz and still maintain the α-quartz crystal structure. It is believed that many practical applications for the solar energy and photoelectric industries will be achieved. First, the natural quartz should be crushed, sieved, magnetic separated, acidic leaching, washing and dried to be the experimental material. Following treated with low temperature water quenching process to promote the cracking along the grain boundary which due to the residual stress of quenching. Since the grain boundary cracks created and impurities exposed, the process of acidic leaching together with ultrasonic cleaning was applied. If the effect of acidic leaching not remarkable enough, still other purification methods can be proceed which included frequency conversion ultrasonic cleaning, low temperature high pressure (hydrothermal), high temperature negative pressure or high temperature high vacuum processes. From experimental results shown that, the best purified processes are after 600°C water quenching, followed by hydrothermal treatment mixed with the hydrochloric acid and hydrofluoric acid in the ratio of 4:2. The outcome data showed that the impurity elimination rate of De-hua quartz powder achieved 76%, respectively. Even the high crystallinity and perfect crystal structure Sri Lanka quartz powder could also achieve 31% elimination rate. Comparing the purity of purified De-hua quartz powder with the standard of American UNIMIN highest solar grade powder, found that almost all metal impurities and total amount impurity have conformed the standard except the sodium content. Therefore, we believed that De-hua powder should be satisfied the needs of manufacturing the poly silicon quartz crucible, even fitting the requirement of outer layer quartz powder for single silicon quartz crucible for solar and/or semiconductor industries.

Keywords : Water Quenching、Acidic Leaching、Hydrothermal Process、Purification、α-Quartz、Impurity Elimination Rate

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