

Profitable Project Investment Opportunity in Extraction of Ultrapure Silicon from Rice Husk Ash

Description:

Silicon, the second most abundant element on earth, is an essential part of the mineral world. Its stable tetrahedral configuration makes it incredibly versatile and is used in various ways in our everyday lives. Burning the fuel, rice husk to generate energy results in the waste product called rice husk ash (RHA). RHA is an abundant agricultural by-product. It is rich in silica (about 60%) and can be made into economically viable raw material which can be used for production of ultrapure silica. The present work deals with the production of silica particles.

Properties of Silicon

Silicon is a crystalline semi-metal or metalloid. One of its forms is shiny, grey and very brittle (it will shatter when struck with a hammer). It is a group 14 element in the same periodic group as carbon, but chemically behaves distinctly from all of its group counterparts. Silicon shares the bonding versatility of carbon, with its four valence electrons, but is otherwise a relatively inert element.

Process of extraction

1. Digestion: This involves the digestion of the rice husk ash with caustic at specific conditions. In this process the silica in the ash is extracted with caustic to form sodium solution. After the completion of the digestion the solution is filtered for the residual undigested ash present in the solution. The clear filtrate is taken for precipitation.

2. Precipitation: This step involves precipitation of silica from the sodium silicate solution. Carbon dioxide at a specific flow rate is passed through the silicate solution at design conditions. Continuous stirring is employed during the operation. The precipitated silica is filtered, washed with water to remove the soluble salts and dried. The filtrate containing sodium carbonate is taken for regeneration.

3. Regeneration: Regeneration is the step where calcium compound reacts with the sodium carbonate to form calcium carbonate and sodium hydroxide. The resulting solution is filtered to remove the solid calcium carbonate and aqueous sodium hydroxide is used for digestion again. The calcium carbonate is washed with water and dried. The dried calcium carbonate can be either calcined to get calcium oxide, which is reused, for regeneration or the calcium carbonate is sold and fresh calcium hydroxide is used for regeneration which gives an option of one more value addition.

4. Production of Ultrapure Silicon: A chlorine based system is used in the method of transferring silicon from SiO_2 to polysilicon. The process is flexible enough to allow the use of chlorine as the halide conversion medium by modifying the process, hydrogen, argon and a silicon chloride containing gas are injected into inductively coupled plasma operating at a temperature of approximately 2500°C .

Under these conditions, the silicon chlorides decompose to silicon, chlorine, and possibly hydrogen ions, and the gaseous product flows into a baffled cold trap held at approximately 1500°C . by resistance heating.

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