Contribution ID: **130** Type: 口头报告

CO_2 低温焙烧-消泡剂辅助浸出提纯线切割晶硅废料

摘要

本研究针对太阳能光伏产业金刚线切割晶硅废料的资源化回收难题，提出了一种基于 CO_2 低温焙烧预处理-消泡剂辅助湿法浸出的新型提纯工艺。该技术通过 CO_2 低温焙烧有效分解废料中的有机碳和无机碳，显著降低碳残留；同时，在后续酸浸过程中引入高效消泡剂，成功抑制了因硅粉与酸反应产氢导致的气泡积聚、硅粉溢出等问题，使硅回收率提升至 80% 以上。与传统湿法工艺相比，本研究通过优化酸浸体系及工艺参数，实现了更高效的杂质脱除：氧含量降至 0.2%，镍、铁等金属杂质去除率分别达 80% 和 90% 以上，最终获得 4N 级硅粉。本工作不仅为光伏硅废料的绿色再生提供了低能耗、低酸耗的解决方案，还可降低回收成本，对促进光伏产业链的循环经济与可持续发展具有重要应用价值。

关键词

线切割晶硅废料；消泡剂；湿法提纯；除碳；除氧

Abstract

This study addresses the challenge of resource recovery from silicon wafer waste generated by the diamond wire sawing process in the solar photovoltaic industry, and proposes a novel purification process based on low-temperature CO_2 roasting pretreatment and wet leaching assisted by defoaming agents. This technology effectively decomposes organic and inorganic carbon in the waste through low-temperature CO_2 roasting, significantly reducing carbon residue. Additionally, the introduction of efficient defoaming agents during the subsequent acid leaching process successfully suppresses the accumulation of bubbles and the overflow of silicon powder caused by hydrogen production from the reaction between silicon powder and acid, increasing the silicon recovery rate to over 80%. Compared with traditional wet processes, this study optimizes the acid leaching system and process parameters to achieve more efficient impurity removal: the oxygen content is reduced to 0.2%, and the removal rates of metal impurities such as nickel and iron reach over 80% and 90%, respectively, ultimately obtaining 4N grade silicon powder. This work not only provides a low-energy and low-acid-consumption solution for the green recycling of photovoltaic silicon waste but also reduces the recycling cost, which has significant application value for promoting the circular economy and sustainable development of the photovoltaic industry chain.

Keywords

Wire-cutting silicon wafer waste; defoamer; hydropurification; carbon removal; oxygen removal

Author: Dr 罗, 雯 (昆明理工大学冶金与能源工程学院)

Co-author: 胡, 国琛 (昆明理工大学)

Presenter: Dr 罗, 雯 (昆明理工大学冶金与能源工程学院)

Session Classification: 环、化、材、技、能源战略

Track Classification: 03 口头报告: 环、化、材、技、能源战略