

European Solar and Energy Storage Solutions

Photovoltaic panel etching method



Overview

Can salt etching be used to recycle silicon solar panels?

Gao, S., Chen, X., Qu, J. et al. Recycling of silicon solar panels through a salt-etching approach.

What is the etching process?

The etching process is enabled by the high corrosivity of molten hydroxide that spontaneously reacts with SiN_x , SiO_2 , Al_2O_3 and Al at the surface of Si wafers through the top-down direction, thereby directly separating Ag from Si wafers. The etching process takes only 180 s to recover >99.0% of Ag and >98.0% of Si from end-of-life Si solar panels.

What etching solution is used to etch silicon wafers?

Kang et al. (2012) submerged silicon wafers in an etching solution comprising hydrofluoric acid (HF), nitric acid (HNO_3), sulphuric acid (H_2SO_4), acetic acid (CH_3COOH), and distilled water (H_2O) for a duration of 20 min. This process resulted in the recovery of 86% of 99.999-grade silicon.

Does salt etching reduce the environmental impact of solar cells?

The LCA analysis shows that the salt-etching process has a smaller environmental footprint in terms of carbon emissions, secondary waste production and energy consumption. Thus, this clean recycling method solves the upcoming material crisis and helps us to underpin the sustainable development of solar cells.

Can a high-voltage pulse method enrich PV panel waste?

After separation, there was a 30% increment in silver concentration. Moreover, the processing cost of this method is found to be around 0.0019 \$/W, making it an economical solution for recycling PV panels. Zhao et al. (2020) performed a parametric investigation on a high-voltage pulse method to enrich PV panel waste.

Are acid etching tools commercialized?

Authors reported that acid texturing method using an in-line texturing system have been commercialized and two of the industrial acid etching tools with a throughput of 1800 wafers/hour have been sold to PV manufacturing units by then.

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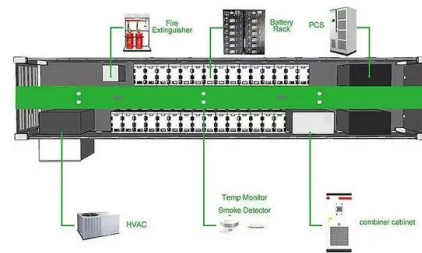


Wet etching processes for recycling crystalline silicon ...

Each etching process consisted of two steps: (1) first etching carried out using a nitric acid (HNO_3) and hydrofluoric acid (HF) mixture and potassium hydroxide (KOH), (2) second etching carried out using phosphoric acid (H_3PO_4) and a ...

(PDF) Nature Sustainability (2024): Recycling of silicon solar panels

As the lifetime of the c-Si solar panel is around 30 years, cumulative PV wastes will reach 80 Mt by 2050. We compared the salt-etching method with a typical alkali



Etching methods for texturing industrial multi-crystalline silicon

This article reviews various etching methods reported for texturing mc-Si wafers under the light of basic reaction mechanism, general composition of chemicals used, merits, ...

Etching methods for texturing industrial multi-crystalline silicon

Screen printed crystalline silicon (Si) solar cell panels continue to dominate the global installation of photovoltaic (PV) modules with a market share of about 95% [1].Multi ...



Photovoltaic Manufacturing: Etching, Texturing, and Cleaning: ...

Figures 1 and 2 visualize the impressive progress in photovoltaics, depicting the best research cell efficiencies (Figure 1) and the champion module efficiencies (Figure 2). Both figures start ...

Etching

The etch rate of alkaline etch solutions are generally lower than at he etch rates of acidic etching solutions. Consequently, alkaline etch processes are often performed at high temperatures (70-80 °C). Alkaline etching is typically ...



Photovoltaic manufacturing : etching, texturing, and cleaning

1.4 Photovoltaic Solar Cell Applications of MacEtch Black Silicon; 3.3.2 Redox System of Metal-Assisted Chemical Etching; 3.4 Methods of Metal-Assisted Chemical Etching; 3.4.1 Two ...

Recycling of silicon solar panels through a salt-etching

...

Here we report a simple salt-etching approach to recycle Ag and Si from end-of-life Si solar panels without using toxic mineral acids and generating secondary pollution. The etching process is enabled by the high ...



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