Short Communication

Surface Texturization of Multicrystalline Silicon with Electrochemical Etching in NaOH/H₂O Solution for Solar Cell Application

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Preparation of the anti-reflective (AR) texture on crystalline silicon (c-Si) surface is an effective way to improve the c-Si solar cell performance. The surface texturization of multicrystalline silicon (mc-Si) is usually performed by chemical etching (CE) in HNO₃/HF/H₂O solution and the obtained surface reflectance (R) is normally higher than 20%. Here, a novel method based on electrochemical etching (ECE) in NaOH/H₂O solution was proposed for the surface texturization of mc-Si. Via the proposed alkaline ECE process, a macroporous texture with the pore feature size of about 100–200 nm could be prepared on the mc-Si wafer surface, reducing the weighted average surface reflectance (R_a) in a wide wavelength range of 400–1100 nm to be about 18.5%. To ensure the complete removal of the damaged layer on the mc-Si surface, the ECE process could be performed on mc-Si pretreated by the traditional CE process in HNO₃/HF/H₂O solution. Such two-step way resulted in a hierarchical texture with the macroporous structure superimposed onto micrometer-sized CE pits, which lowered the above R_a to be about 17.5% further. As a comparison, R_a was high up to 24.8% if only the traditional acidic CE process was carried out individually. The results indicated that such a novel ECE process in NaOH/H₂O solution had a great application potential to make the AR texture for the mc-Si solar cells.

Keywords: NaOH/H₂O solution; Electrochemical etching; Texturization; Multicrystalline silicon; Solar cell

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