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Influence of Surface Preparation and Cleaning on the Passivation of Boron Diffused Silicon Surfaces for High Efficiency Photovoltaics

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Abstract:

The use of proper surface preparation and cleaning methods for Si wafers prior to the deposition of passivation layers is essential to minimize surface recombination and realize high efficiencies (>20%) in crystalline Si photovoltaic cells. In this work, the influence of wafer cleaning on the quality of surface passivation achievable for boron-doped emitters was investigated, including the use of different combinations of HCl, HF, HNO₃, and ozonated deionized water (DIO₃). These different surface preparations and cleaning sequences were performed on undiffused and boron diffused *n*-type Cz Si wafers, followed by the deposition of either silicon nitride (SiN_x) or an aluminum oxide film capped with SiN_x (Al₂O₃/SiN_x stack). Additionally, both planar and anisotropically textured wafers were used. Injection-level dependent photoconductance measurements and calibrated photoluminescence imaging were performed on symmetrical boron diffused samples based on the different cleaning processes and passivation materials described

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