Interface Engineering and Modulation of Nickel Oxide for High Air-Stable *p*-Type Crystalline Silicon Solar Cells

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Abstract

Dopant-free passivating contact crystalline silicon solar cells hold the potential of higher efficiency and cost down. In the hole-transport terminal, one still faces the challenge of trade-off between efficiency and stability. in this work, a H-Al_2O_3/NiO_x/Ni stacked hole-transport layer is proposed, where the H- Al_2O_3 standing for H-rich Al_2O_3 film can effectively reduce the interfacial defects and the high work function Ni metal results in a low contact resistance of 47.12 mΩ $cm^{2.}$ Consequently, the solar cell achieves an efficiency of 20.51%, with a fill factor of 84.83%, demonstrating satisfactory stability. This work provides a strategy for reducing interfacial defects and highlights the potential of stacked structure design for enhancing passivated contact solar cell performance.

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