

**PIENAAR ENERGY (PTY) LTD**

# **Sodium ion migration in solar glass**



## Overview

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Sodium ions from soda-lime glass migrate through the encapsulant and accumulate at the cell's ARC layer and p-n junction. This causes surface charge buildup, increased surface recombination velocity, and a drastic reduction in shunt resistance. PID is a phenomenon that can significantly reduce the performance of solar panels, primarily driven by voltage-induced ion migration within the glass and encapsulating materials. Understanding the mechanisms behind PID is crucial for developing more durable solar panels and enhancing their operation. It is a challenging reliability issue in crystalline Si modules. It has been linked to PID and power losses but very little is understood about its migration. The edge-to-center progression clearly proves electric field concentration toward the grounded aluminum frame. When the poling voltage is applied to the glass sample, mobile ionic species migrate from the anode (or bulk) towards the cathode, resulting in an increased voltage drop near the anode thus, ionic migrations and migration into the SiN<sub>x</sub> films. Different possibilities in sodium ion migration control are presented, considering the influence of glass composition on sodium diffusion and its chemical. Introduction Potential-induced degradation rapidly and significantly affects the photovoltaic (PV) module's performance due to a high potential difference across the PV cell and the grounded module's frame. [1] PID has various types where PID of the shunting type (PID-s) is common within silicon PV.

## Sodium ion migration in solar glass

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### Sodium ion migration in photovoltaic glass

The EL darkening was primarily attributed to shunting caused by sodium ion migration from the glass into the active material of the cell, but the authors also noted other contributing mechanisms, ...

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### Insights into Na diffusion in Silicon Modules under Operating ...

PID and power losses but very little is understood about its migration. In this paper we present our investigations of sodium ion migration in ethylene-vinyl acetate (E. A) and silicon through Dynamic ...



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### Sodium Ion Migration Causes PID in Solar Modules

A sharp degradation boundary between bright and dark regions is a classic signature of sodium ion ( $\text{Na}^+$ ) migration from the glass into the cell surface.

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## Sodium Diffuses from Glass Substrates through P1 Lines and ...

In this work, we use complementary microscopy and spectroscopy techniques to show that Na diffusion occurs in the fabrication process of PSMs. Na diffuses vertically inside P1 lines and ...



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## Contribution of Na<sup>+</sup> from Glass to PID-s in Solar Modules: Na ...

In this paper we evaluate the ion migration kinetics in encapsulant material under operational conditions. Analysis of Na migration profiles reveal the diffusivity constant and activation ...

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## Sodium ion migration in glass on electron beam irradiation

Sodium ion migration in glass on electron beam irradiation D M Usher lington, Received 1 September 1980 Abstract. The phenomenon of electromigration of atomic species during AES of glasses is ...



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## PID Failure Mechanisms: Sodium Ion Migration

## Pathways in Glass

Sodium ions are commonly found in the glass used in solar panels, typically as a result of the composition of the glass material or contamination during manufacturing. Under outdoor ...

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## Suppression of the shunting-type potential induced degradation (PID-s)

In this study, we investigated the shunting mechanism (PID-s), mainly linked to the migration of sodium ions ( $\text{Na}^+$ ) from the glass to the cell junction. Soda-lime silicate glass, commonly ...

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## Alkali ion migration control from flat glass substrates

Different possibilities in sodium ion migration control are presented, considering the influence of glass composition on sodium diffusion and its chemical potential as well as passivation of sodium ...

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