Encapsulant based solution to Potential Induced Degradation of Photovoltaic Modules *

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**Introduction**

In solar power installations, modules made of isolated solar cells are connected in series to achieve desired supply voltage. The module frames are also grounded to prevent electrical shock hazards. The large potential created by this architecture between the metal and ground has been shown to cause small leakage currents across the modules protecting the cells. Leakage current over time has been associated with reduced power output from the system. This phenomenon has been called potential induced degradation (PID). According to materials used in the module construction, the cells become electrically important in designing PID resistant modules. In this study, electrical properties of encapsulants necessary for effective PID mitigation are evaluated. Accelerated testing of PID on single and multiple module configurations made with different encapsulants at elevated temperatures are related to the electrical properties of the films. ENLIGHT™ films show orders of magnitude higher volume resistivity compared to EVA at 150°C, it is also seen that the resistivity over broad temperature range is essential to minimize the effects of PID.

**PID Testing**

- Propose single cell modules with SRC 4 connector junction boxes
- Fasten them to get low leakage power, focus on the performance range of the module
- Place them in the case at 80°C and 85% RH and apply ~300-V to the cells with respect to the frame
- Age for 56 hours with voltage applied
- Fasten the modules to check for failure power, do D.C. measurements to look for failures

**PID Test Results**

- EVA tested with ENLIGHT™

**Electroluminescence Measurements**

Before

After

**Extended Module Reliability Data**

PID resistant cells – severe conditions can lead to power drop

**Summary**

- PID has been shown to be a significant issue in crystalline silicon modules in the field
- There have been solutions suggested to solve the issue by changing the coating on solar cells or changing the grounding configuration
- In this work, we present an approach by using polyethylene based encapsulant in place of EVA which does not lead to any change in the type of cells used or the installation process
- It was found that electrical insulation resistance and lower water vapor transmission are required to prevent ion migration and PID
- ENLIGHT™ Polyethylene encapsulant film provides two orders higher volume resistivity and one order lower water vapor transmission rate which in turn helps modules resist PID.