Suppression of potential-induced degradation in crystalline Si photovoltaic modules

Introduction of a TiO_2-based thin film by coating on the glass substrate

Potential-induced degradation (PID) in crystalline Si photovoltaic (PV) modules consisting of a soda lime glass substrate, copolymer of ethylene and vinyl acetate (EVA) as the encapsulant, and a back sheet was generated by applying -1000 V at 85 °C. In the PID test, the solar energy-to-electricity conversion efficiency of the standard Si PV module remarkably decreased from 15.9 % to 0.6 % after 2 h. On the other hand, degradation by PID was remarkably suppressed by the introduction of a TiO_2-based thin film by coating on the glass substrate of the module. These results indicate that our technique is one of the attractive and promising techniques for producing low-cost PID-resistant Si PV modules.

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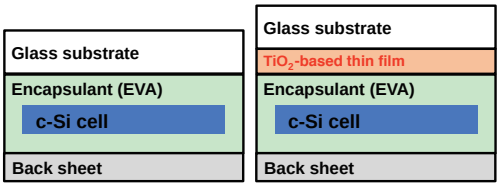
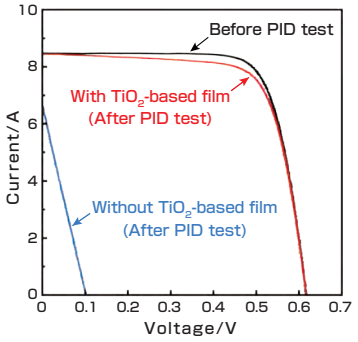


Structures of a standard crystalline Si photovoltaic module (left) and a PID-resistant module (right) produced in this research



The I-V curves for a standard Si photovoltaic module and a PID-resistant module before and after the PID test by applying -1000 V at 85 °C for 2 h

High-purity, chloride-free epoxy resin

Applicable to conductive adhesive achieving super high performance

Highly effective catalytic process to synthesize pentaerythritol tetraglycidil ether (PETG) was achieved. Pentaerythritol tetraallyl ether (PETE) was oxidized by the optimized catalytic system including tungsten compound, amine, and additives, to give the target of over 80 % reactivity with 80 % selectivity under organic solvent-free reaction conditions. Generated PETG fulfilled 1) high temperature resistant properties, 2) good optical properties, 3) good electrical properties and weather resistance for a long term for practical use. Trial production of conductive adhesive was carried out. The conductive adhesive showed below values of 10 N strength of adhesive bonding and 10^{-3} Ωcm of resistivity to achieve the desired values.

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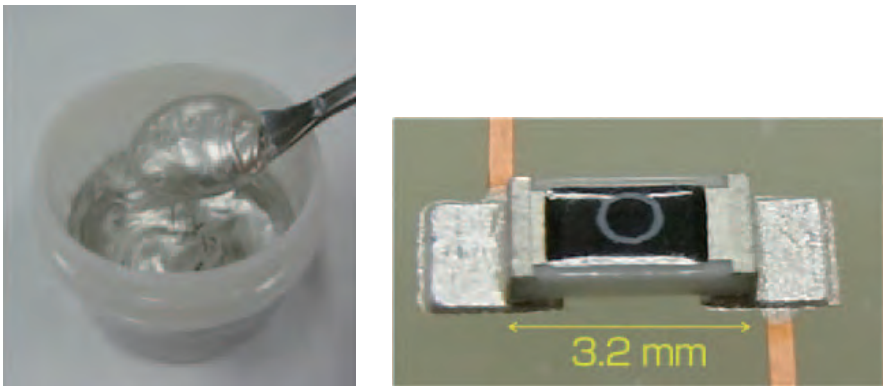

Conductive adhesive (left) and application to chip bonding (right)