

## Analyzing the Effect of Cleaning on Anti Reflecting Coating of PV Module

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### Abstract

Solar energy which is cheap and present in abundance in tropical and subtropical regions has been universally accepted as future source of energy and photovoltaic cells are considered as potential candidates to harness this energy. In the recent years, India being its proximity to equator has increased the installation of PV systems in a huge way because of the higher irradiation available in large part of the country. India has seasonal variations from extreme cold to scorching heat, sand & dust storms, fog and heavy rain fall during monsoon. All these extreme metrological conditions causes accumulation of soil on PV modules which adversely affect the optimized output of modules. Removing of dust & dirt from the surface of module require cleaning of the module surfaces at regular interval. For this study 12 PV module were selected out of which six were based on mono-crystalline silicon and another six were of poly-crystalline silicon technology of 6 samples each. All the PV modules were made up of 72 cells configuration with 6 rows x 12 columns. Initially, after recording the important parameters such as Voc, Isc, Vmp, Imp, and cell efficiency etc as per manufacturers information the Visual Inspection Test was conducted of all the 12 PV modules as IEC and internal standard protocol. Electroluminescence Test, STC Performance Test, ultrasonic thickness test, reflectance and soiling test were conducted and the data recorded as base data.

To simulate the extreme soiling conditions on the solar PV modules the desert soil which is mostly sandy soil (90-95%) was used. To study the soiling effect the scale of 100 cycles was taken which was further divided into 3 stages, first stage was from 0 to 30 cycle, second stage from 31 to 60 cycles and third stage from 61 to 100 cycles.

The desert soil was collected in a cloth bag of fabric with small pores through which fine sand particles were sprinkled manually on the solar PV modules. Initially, for first and second stage the 26 grams of fine desert soil taken in a cloth bag and out of which only 35 to 40% (approx 10gm) soil passes through the pores and accumulated on PV modules. For third stage a bag of 180 gm desert soil was used to sprinkle 50 gm of soil on the surface of test modules. Dry Robotic Cleaning Technology is used for cleaning of the panels. Impact of regular cleaning on panel performance was evaluated by analyzing the effect of cleaning on the glass surface and Anti-reflection coating present on the PV modules.

The parameters like; total reflectance, diffuse reflectance and spectral reflectance of light from the module surface were calculated and removal of ARC coating was assessed by performing Ultrasonic Thickness Measurement Test at eight different location of the PV modules.

**Keywords:** soiling, anti reflection coating, PV modules