

Artificial Dust Deposition Using Water as Carrier Solvent (PV-5)



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Scientific Achievement:

We developed a method to replicate the natural process of dust deposition on the solar modules in a laboratory environment using deionized water (DI) water as a carrier solvent. DI water is used as a carrier solvent because water, in the natural environment, is present in the form of moisture and dew drops that causes dust deposition and hence leads to cementation of dust over the surface.

Significance and Impact:

Evaluation of soiling loss on PV modules based on field measurements is usually a time-consuming and expensive undertaking. With this method, we can estimate the energy loss due to dust deposition, and mitigation techniques can be developed in a laboratory environment.

Research Details:

- In this method, we used vertical dust deposition and the duration of each spray was much less to obtain uniformity in the sample.
- FTIR results showed that acetonitrile-based dust deposition overestimates the short-circuit current (I_{sc}) and quantum efficiency (QE) losses, especially around 450 nm.
- Acetonitrile changes the chemical composition of the dust. To resolve these issues, DI water is used as a carrier solvent.

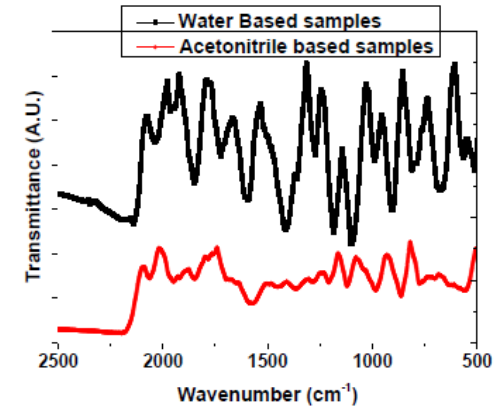


Fig. 1: FTIR spectra of dust samples deposited using acetonitrile and water as carrier solvent.

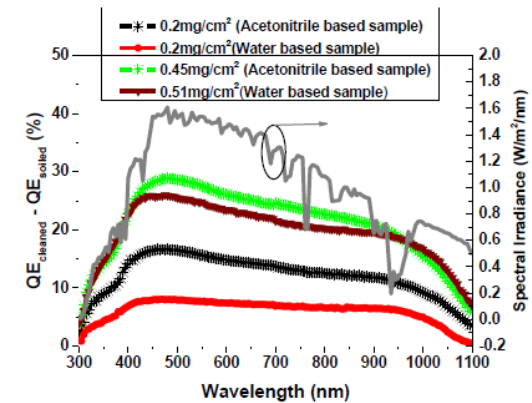


Fig. 2: Comparison of QE loss of multicrystalline silicon solar cell with acetonitrile-based samples and water-based samples.

Publication(s): S. Bhaduri, S. Warade, J. John, B. Kavaipatti, and A. Kottantharayil, "Artificial Dust Deposition using Water as Carrier Solvent for Investigation of Soiling Losses in Photovoltaic Modules," in *43rd IEEE Photovoltaic Specialist Conf.*, Portland, OR, 2016.

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