

Investigation – Characterization – Testing

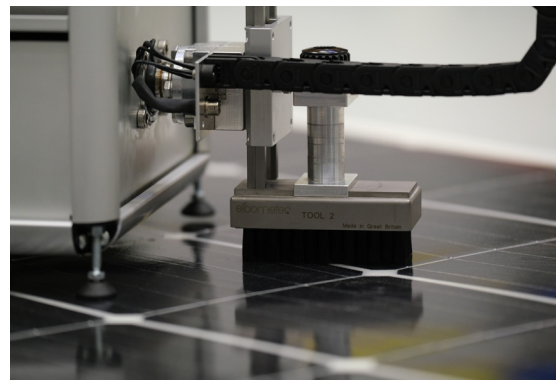
Abrasion in Photovoltaics

Motivation

Due to the accumulation of dust and other contaminants on the surfaces of solar energy systems (PV modules, CSP mirrors), significant yield losses can occur. Accordingly, cleaning of the glass surfaces is usually carried out, which leads to high mechanical loads on the glass surfaces. Regular cleaning can thereby damage the glass surfaces, the anti-reflective coatings (ARC) commonly used on PV modules, and thus jeopardize the 2 to 3 % performance increase associated with ARC.

Test Facilities

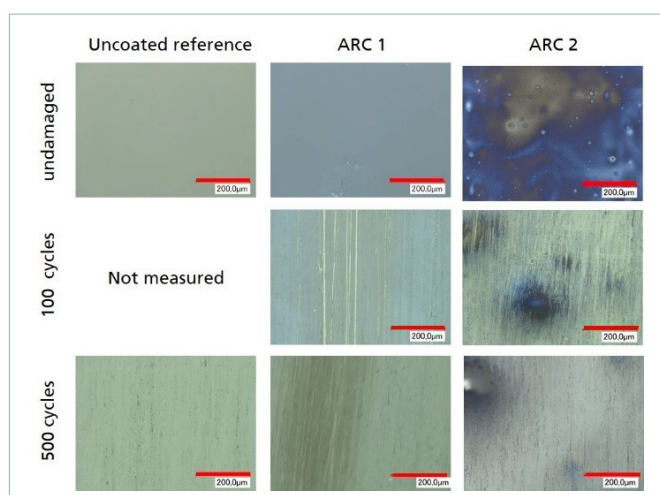
Fraunhofer CSP operates standardized test facilities according to DIN-SPEC 4867, with which surfaces of solar energy systems (up to PV module formats) can be tested with regard to their resistance to real cleaning loads in Europe and desert regions. A large-area test washing system for rotating brush cleaning and a small-area mobile abrasion tester for linear brush cleaning are used.



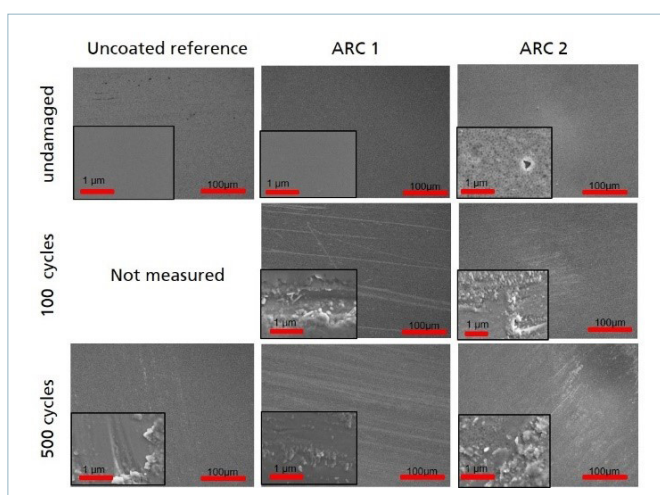
Abrasion tester developed at Fraunhofer CSP for testing the resistance of surfaces to cleaning processes.



Abrasion test with linear brush cleaning under the influence of a standardized test dust.



Light microscopic representation of various damage patterns.



Microstructural analysis of abrasively damaged surfaces.

Features

Large-area test washing system for rotating brush cleaning

- Full-surface abrasion tests with wet-rotating brush cleaning with defined dust-water suspensions according to newly developed test standard DIN-SPEC 4867
- Specimen sizes: 20 x 20 cm - 110 x 210 cm

Small area mobile abrasion tester for linear brush cleaning

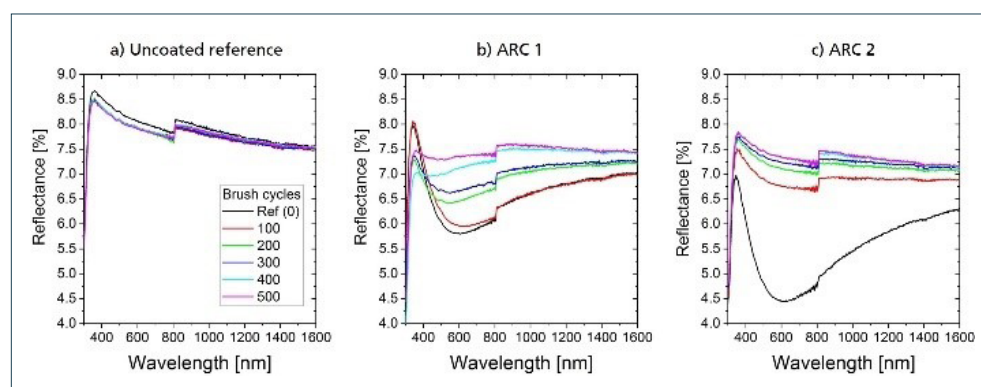
- Test method based on ISO 11998 and ASTM D2486 standards
- Brush specifications according to ASTM D2486 (nylon, 454 g)
- Sample sizes: 10 x 10 cm - unlimited (tester is placed on glass)

Quantification

At Fraunhofer CSP, the damage potential of user-specific cleaning parameters and materials can be evaluated and assessed.

Typical diagnostic methods are:

- Measurement of transmittance and reflectance after each test cycle according to IEC 62805-2.
- In-situ determination of abrasion-induced reduced anti-reflectivity by optical reflectance spectroscopy
- Imaging analysis by optical microscope and secondary electron microscopy (SEM)



Reflectance spectroscopic measurements show the abrasion-induced reduction in the anti-reflectivity of various coatings.

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