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Laboratory intercomparison of solar absorptance and thermal emittance measurements at room temperature

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Abstract-

Solar thermal absorber coatings play an important role in the opto-thermal efficiency of receivers in Concentrated Solar Power (CSP). Two standard figures of merit are the solar absorptance αsol and thermal emittance εth, derived from spectral directional hemispherical reflectance measurements at room temperature. These two figures of merit allow comparing coating formulations in terms of performance and durability.

In this study, a black coating and a solar selective coating are optically characterized by different laboratories to compare spectral datasets, solar absorptance αsol and thermal emittance εth calculations. The comparison includes various benchtop spectrophotometers operating in the UV-VIS-NIR and Infrared spectral ranges as well as three commercial portable reflectometers/emissometers.

A good agreement is found between the nine parties participating in this intercomparison campaign. The black coating αsol value is 96.6 ± 0.2%, while the solar selective coating αsol value is 94.5 ± 0.4%. For the thermal emittance, spectral data is concatenated and integrated from 0.3 to 16 μm. The black coating εth value calculated at 650 °C is 80.8 ± 3.8%, while the solar selective coating εth value calculated at 650 °C is 25.0 ± 0.5%.

Index Terms- Concentrated solar power; Solar thermal; Absorber coating; Solar absorptance; Thermal emittance

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