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Published in: Proceedings of the 33rd European Photovoltaic Solar Energy Conference and Exhibition

Publication date: 2017

Document Version: Publisher's PDF, also known as Version of record


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INDOOR MEASUREMENT OF ANGLE RESOLVED LIGHT ABSORPTION BY ANTIREFLECTIVE GLASS IN SOLAR PANELS

Mekbib W. Amdemeskel¹, Gisele A. dos Reis Benatto¹, Nicholas Riedel¹, Beniamino Iandolo², Rasmus S. Davidsen², Ole Hansen², Peter B. Poulsen², Sune Thorsteinsson¹, Anders Thorseth¹, Carsten Dam-Hansen¹

¹Department of Photonics Engineering, Technical University of Denmark, Frederiksborgvej 399, 4000 Roskilde, Denmark
²Department of Micro- and Nanotechnology, Technical University of Denmark, Ørsteds Pl., 2800 Kongens Lyngby, Denmark

Introduction

The effect of the angle of incidence (AOI) on the optical properties of the cell is considerable for AOI larger than 45° and needs to be taken into account when assessing performance of solar cells, including the antireflective (AR) glass.

In this work, we normalize the relative short circuit current to a cosine response thereby isolating the optical effect of the glass-air interface. This form of data presentation is frequently described as the "incidence angle modifier" (IAM) and is used in PV modelling programs such as PVsyst.

Results

After $I_{sc}$ - AOI measured:
- Area correction for angles >±75° IAM
- Normalized to AOI = 0°

Since we used a collimated light source, we neglected the diffuse component.

Simulations

- IAM data were used to create unique PV module files in PVsyst.
- Energy production of a 10 kWpeak grid-tied system.
- The locations selected so as to span a variety of latitudes.
- PV balance of system (BOS) was also kept constant in all simulations.
- A fixed-tilt rack relative to a horizontal plane was equivalent to the location’s latitude.

Conclusions

- The results indicated that the different AR glasses present diverse optical effects from angles intervals between 0 – 45° and 60 – 90°.
- PVsyst simulations showed that Diffuse Glass sample can improve monthly yields by as much as 2% relative to Structured Glass 2 sample.
- Based on the PVsyst simulations, we consider the setup presented a valuable tool for indoor measurements of the IAM i.e. the angular performance on solar cells and mini modules.

Outlook

- Round Robin between other laboratories with AOI cell testing indoors and outdoors, for a comprehensive setup validation.
- Modelling of different glass types on BIPV systems, where the installed tilt angle does not allow for receiving the optimal amount of solar irradiance.

References