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Advances and Challenges of Cover Glasses for Efficient Harvesting of Solar Electricity

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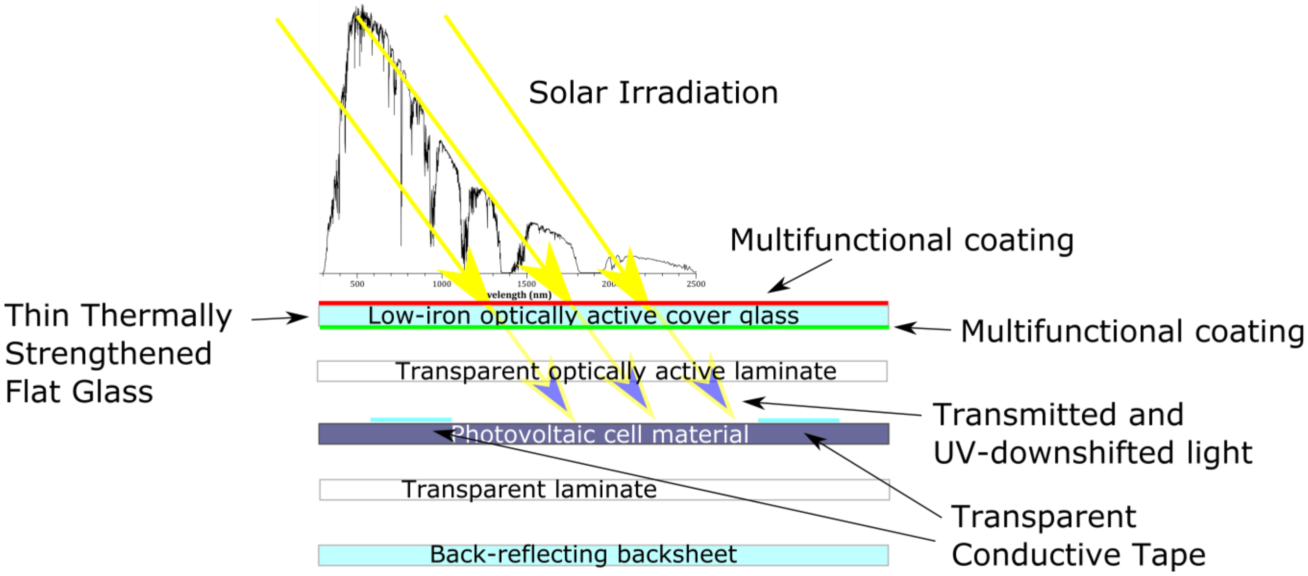

Ideal material choices for highly efficient harvesting of solar electricity in photovoltaic modules.

Abstract

Harvesting of solar energy through photovoltaic (PV) modules is an essential technology for increasing the share of renewable energy sources, both immediately and in the future. The glass cover material constitutes a significant part of the cost. Research and development of the cover glass is needed to increase the service lifetime and to reduce the cost per watt peak [1]. Recent research efforts in the LIMES project show that the addition of optically active components absorb harmful UV light and simultaneously convert those UV photons into visible light [2]. Thus, the profit is two-fold, increasing both service lifetime and efficiency by up to 4%. Further, the cover glass composition can be optimized to enhance the mechanical and chemical durability. It has been shown that it is possible to increase the indentation crack resistance [2] and the hydrolytic durability by three and four times respectively by modifying the glass composition. Thermal strengthening of glass for PV modules are required for mechanical durability. However, there is an increasing demand of light-weight PV modules, therefor is thermal strengthening of thin cover glass needed to meet the increasing demand. In-situ chemical vapour deposition (CVD) of Al_2O_3 and thermal strengthening of the cover glass provides an additionally crack resistant and chemically durable glass surface. Developments of transparent and robust multifunctional coatings that provide anti-reflective and self-cleaning properties on the outer glass surface are desired [4]. Thereby is maximal transmission and reduced soiling achieved. On the interior surface are anti-reflective and chemical barrier multifunctional coatings desirable to increase transmission and reducing potential induced degradation (PID) [5]. The LIMES concept has been demonstrated by quantitative measurements and as Si solar cells. The scale-up of the LIMES concept and additional material challenges to increase the efficiency and service lifetime will be discussed. Replacing the conventional silver strings in PV modules with transparent conductive tape and back-reflecting backsheet materials are among the promising techniques for further maximizing the efficiency.

Keywords: Solar Energy; Photovoltaics; Solar Glass; Multifunctional coatings; Tempered Glass.

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Reference (Not more than 5, please follow the below reference style if any).

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