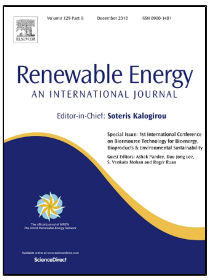
Accepted Manuscript



Improving spectral modification for applications in solar cells: a review

Joseph Day, S. Senthilarasu, Tapas K. Mallick

PII:	S0960-1481(18)30898-X
DOI:	10.1016/j.renene.2018.07.101
Reference:	RENE 10375
To appear in:	*Renewable Energy*
Received Date:	12 March 2018
Accepted Date:	20 July 2018

Please cite this article as: Joseph Day, S. Senthilarasu, Tapas K. Mallick, Improving spectral modification for applications in solar cells: a review, *Renewable Energy* (2018), doi: 10.1016/j.renene.2018.07.101

Improving spectral modification for applications in solar cells: a review

Joseph Day*, S. Senthilarasu, Tapas K Mallick

Environmental and Sustainability Institute, University of Exeter, Penryn Campus, Cornwall TR109FE, UK

Corresponding Author: jd553@exeter.ac.uk

Abstract

The spectral mismatch between solar cells and incident radiation is a fundamental factor limiting their efficiencies. There exist materials and luminescent processes which can modify the incident sunlight's properites to better suit the cell's optimal absorption regions. This makes for an interesting area of research and promising technique for enhancing the efficiency of solar cells which is important for environmental reasons. It is intended for this review to provide the reader with historical and up-to-date developments of the application of spectral modification to solar cells and contribute to growing its impact on real-world PV devices. We concisely outline the underlying principles of three spectral modification processes: upconversion (UC), downconversion (DC) and luminescent downshifting (LDS). For each section we present up to date experimental results for applications to a range of solar PV technologies and discuss their drawbacks. With particular focus on UC, we then review how nanostructures or integrated optics might overcome these problems. Finally, we discuss practical challenges associated with advancing this approach for commercialisation and opportunities spectral modification presents; namely where future research should focus and via a cost analysis with a simple formula that can be used to determine financial viability for the deployment of this technology.

Keywords

Downconversion, Efficiency, Luminescent Downshifting, Nanostructures, Solar Cells, Upconversion.

Contents