

INCREASING THE KILO-WATTS WITH NANO-RODS: APPLICATIONS OF ZINC OXIDE NANO-ROD ARRAYS IN THIN FILM PHOTOVOLTAICS

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Zinc oxide nanorod arrays (ZNA) have been prepared by using simple electrodeposition at 75 °C. By control of the voltage, seeding layer and chemical solution a library of nano-rod diameters, lengths, geometries and packing densities can be achieved.

One successful application of the ZNA is as an anti-reflection coating on copper indium gallium di-selenide (CIGSe) thin film solar cells. This works as the ZNA is a sub-wavelength structure which acts as a zero-order grating (otherwise known as the moth eye effect). An impressive 5.8 % increase in the short circuit current density was achieved without significant loss in the open circuit voltage [J.Chen et al. Solar Energy Materials & Solar Cells 95 (2011) 1437-1440]. Currently we are able to deposit the ZNA on substrates of size 10 x 10cm² and CIGSe solar modules of 5 x 5cm².

Optical spectroscopy studies show that ZNA are an excellent light coupling element. We can further tune the optical properties of the ZNAs by embedding or decorating self-assembled silver nano-particles under or over the nano-rods. This and the successful up-scaling of the deposition process also present new opportunities of incorporating the ZNA in a variety of solar cell architectures designed to maximize the use of the solar spectrum.