

Optimization of the performances of textured segmented solar cells: achievements and challenges

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Transparent electrodes transmit light and conduct electrical current simultaneously especially in the visible range [1]. They are used in many applications such as flat panel displays, light emitting diodes and solar cells which is the application of interest in this work. Textured or complex surfaces, in comparison to smooth surfaces, present better properties that once combined with the properties of transparent electrodes can amount to great results; for example, textured cells deliver more photocurrent than planar cells, even at oblique angles [2]. Zinc oxide (ZnO) and Al doped ZnO (AZO) are widely used as transparent electrodes due to the abundance and low cost of Zn and Al compared with Sn and In found in indium tin oxide (ITO) in addition to their high optical and electrical properties [1]. An important technique for depositing (AZO) films is the High Impulse Magnetron Sputtering (HiPIMS) method that allows us to deposit highly conductive and transparent films on large surfaces and at low temperature [3]. Another important technique is the Atomic Layer Deposition (ALD) which is used for depositing high quality thin films due to the self-limiting growth mechanism which enables an excellent surface coverage and conformal deposition on high aspect ratio structures; this method enables us to combine metallic Cu films with semiconductor oxides (ZnO, Cu₂O, or both) leading to many applications in different fields related with optoelectronics, catalysis, gas sensing and photovoltaics [4]. Cuprous oxide (Cu₂O) is a direct-gap semiconductor with a band gap energy of approximately 2.1 eV [5] also used as a transparent electrode. The fabrication of segmented p-Cu₂O/n-ZnO nano-junctions desired in this work is facilitated by (ALD). In this presentation we report on the strategy we are developing to produce segmented textured solar cells based on Cu₂O/ZnO junctions, the applications, achievements and challenges to overcome.

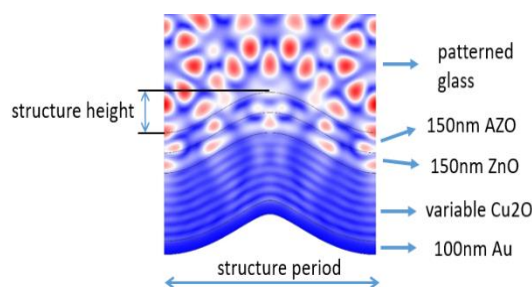


Fig. 1: Simulation of the segmented textured solar cell to be produced (Marcos Soldera, Dresden).

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