Optical and electrical properties of composite AZO electrodes for photovoltaics applications

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One of the main elements of a solar cell is the front transparent electrode layer. Due to its role in solar cells, it should show the lowest possible resistance and the highest possible transmission of sunlight. Presently, the most commonly used material for this purpose is indium-tin oxide (ITO). In our research we focused on more affordable and environment-friendly aluminum-doped zinc oxide (AZO) deposited with ALD technique onto 10 micron line width metal grid with 100×100 μm^2 windows. The thickness of AZO layer was 100 nm (fig. 1). The grid was prepared by means of photolithography technique with use of a specially designed mask. The very first metal for testing as a grid material was 15 nm thick aluminum layer. Although I-V characteristics for aluminum grid with AZO layer was slightly nonlinear, such a construction lead to twice smaller resistance comparing to pure AZO layer. When used as transparent electrode layer it should improve photogenerated carrier collecting efficiency. The modelling of electrical transport in grid-strapped layer is planned for the future. In parallel with the decrease of electrical resistance, the presence of grid resulted in reduction of transmission of AZO layer in the range of solar spectrum, however only by 16% (fig. 2). We believe that altogether the grid construction will improve solar cell efficiency. Our aim is to optimize the grid size parameters as well as the metal itself. Measurements using different metals and different grid size are currently in progress. Finally, we will try to construct solar cell with this new composite electrode to determine quantitatively the influence of the grid on the efficiency of the cell.

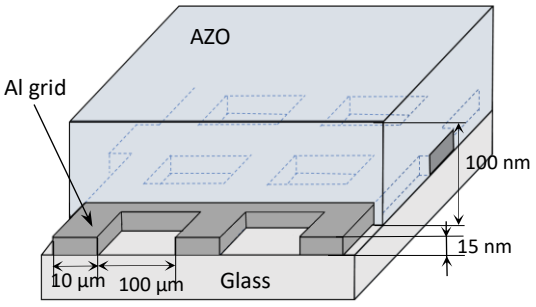

Fig. 1. The scheme of AZO-Al grid electrode

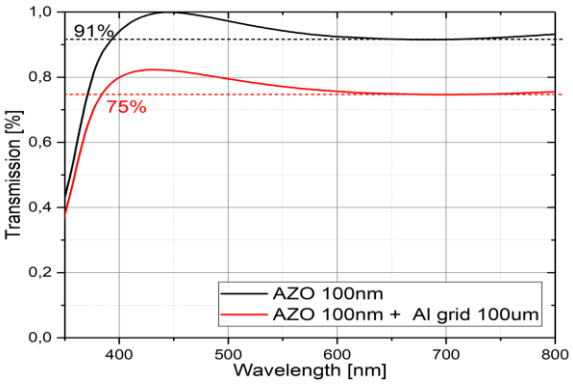

Fig. 2. Light transmission measured in the range of solar spectrum, normalized to glass substrate

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