Electrical Performance of DSSC with Aluminum Doped ZnO Working Electrode

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Dye Synthesized Solar Cells (DSSCs) are important devices. Because they are expected to respond to many environmental and energy problems. DSSCs have many advantages compare to other photovoltaic devices, such as a superior performance in conditions of low intensity, low angle of incidence and high temperature. Since Zinc oxide (ZnO) has better electrical properties, its use in DSSCs is considered to be the best alternative to TiO_2. ZnO has a large excitation binding energy (60 eV), is available at low-cost, and is stable against photo-corrosion. Techniques such as thermal decomposition techniques, hydrothermal, sol-gel method, spraying, microwave assisted hydrothermal are used to obtain ZnO nanopowder. The hydrothermal synthesis (HTS) is a method based on high pressure crystallization from high temperature aqueous solutions. Many factors affect the performance of DSSC, such as the morphology and thickness of the electrode and the type of dye. However, metal doping to increase electrical conductivity and change morphology is also an important factor. In this context, Al-doped ZnO nanopowders were synthesized by HTS method to investigate the effect of Al on the performance of ZnO-DSSC. The synthesized powders were coated on FTO electrode using doctor blade technique. Then the film was calcined at 400°C for 1 h. After the film cooled down to room temperature, it was immersed in ruthenium based and organic dye solutions for 2 h at room temperature. Finally, the dye loaded ZnO films were assembled with the prepared Pt counter electrodes to form a sandwich-type DSSCs using a sealing plastic. The structure of ZnO nanopowders and films was examined using field emission scanning electron microscopy and X-ray diffraction were used to analyze the phase. The current–voltage (I–V) characteristics of the DSSCs were recorded by a solar cell measurement system.