Polypyrrole Based Dye-Sensitized Solar Cell

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The purpose of this work is to make a dye-sensitized solar cell with natural and synthetic dyes. The cell is usually made out of a platinum-covered cathode, which we intend to replace by a cathode covered with the conducting polymer polypyrrole. As the polymer easily peels off, it is necessary to bond it chemically to the cathode with the silane coupling agent 3-(1'-pyrrolyl)propyltrimethoxysilane. First of all, it is important to determine the ideal operating conditions and parameters of the solar cell. We determined the most adequate dye by comparing the absorption spectra of several dyes and by measuring the current–voltage characteristics of cells made out of the synthetic Ruthenium complex « black dye » and two natural dyes: raspberry juice and blueberry juice. It turns out that the "black dye" is most effective after 4 hours of staining time. We synthesized polypyrrole by electrochemical oxidation with and without coupling agent. The polypyrrole without coupling agent has a typical cauliflower structure and easily peels-off form the cathode. The coupling agent allows the polymer to be smooth and improves its adhesion. We built solar cells with different cathodes: graphite, polypyrrole (with and without coupling agent) and platinum. The current–voltage characteristics allowed to conclude, that the platinum solar cell works best, with an efficiency of 4,31 %. Polypyrrole based solar cells are less efficient: 1,85 % with the coupling agent and 1,41 % without. The thickness of polypyrrole is also of importance: the thinner the polymer, the better the cell works. The graphite solar cell is the least effective.

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