Materials for Energy Technology

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The Synthesis of Phenoxazine Dyes Comprising Anchoring Group and Their Performances in Dye Sensitized Solar Cells

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In recent decades, increasing attention has been paid to the development new efficient dyes for dye sensitized solar cells (DSSCs). As a source of renewable energy, DSSCs has potentially low-cost fabrication, economical and effective way to carry out the energy conversion from solar light to electricity and the possible solution for environmental concerns for the future energy demand. This potentials tempted scientists all over the world about the subject since O'Regan and Gratzel[1]. One of the crucial components in DSSCs, the photosensitizers have always attracted ever increasing attention. Due to the better cost performance compared to metal-complex sensitizers, the organic dyes exhibit the more brilliant future in commercial application. Intense effort focused at this area by synthetic organic chemists in according to achive better and better overall efficiencies. But generally synthetic routs for synthesising new materials involves mostly conventional heating which is inefficient and time consuming. Microwave synthesis represents a major breakthrough in synthetic chemistry, gives organic chemists more time to expand their scientific creativity. Insted of spending hours or even days synthesizing a single compound, chemists can now perform the same reaction in minutes[2-6].

In this study, organic sensitizers with phenoxazine core comprising donor, electron-conducting, and anchoring groups synthesized for sensitization titanium dioxide in dye sensitized solar cells. All synthetic steps for the construction of the dyes conducted under microwave irradiations which are N-alkylation, vilsmeier -haack Formylation, knoevenagel condensation. Under microwave irradiation phenoxazine reacts remarkably fast with a number of alkyl halides to give N-alkyl derivatives of phenoxazine especially compared to the traditional organic synthesis using reflux conditions. The reactions were carried out with high yield by simply mixing phenoxazine with an alkyl halide which was adsorb on potassium carbonate Vilsmeier -Haack Formylation and Knoevenagel Condensation reactions was also fast and high yielded. Phenoxazine dyes comprising anchoring groups were characterized by UV-Vis, IR, ^{1}H NMR techniques. The effect of different dye structures on the performance of the DSSCs was investigated systematically with photophysical, photovoltaic as well as photoelectrochemical methods. J-V and IPCE curves were evaluated for photovoltaic performances of phenoxazine dyes. Results showed that phenoxazine dyes exhibited promising photovoltaic properties.

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