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Constructing a Novel Cage Molecule for Use in a Dye-Sensitized Solar Cell

The development of efficient organic dyes for use in dye sensitized solar cells presents a cost-effective and environmentally friendly alternative to expensive silicon solar cells. This study's goal was to construct an organic molecule for efficient use in a dye-sensitized solar cell. I synthesized a dye molecule that consisted of two porphyrin molecules inside a cage framework designed to separate the porphyrin molecules in order to prevent porphyrin aggregation. This separation between the porphyrins was constructed in order to slow the charge recombination process and therefore increase the efficiency of a solar cell using this cage molecule as the functional dye. The definitive process found for forming a porphyrin cage molecule includes forming a four-sided carbozole-porphyrin molecule. Another rinvestigated process involves making a two-armed cage with early conversion of nitryl groups to acetone groups, before the porphyrin is formed. Nitryl and amino groups do not work in this cage formation process, nor does bromine-carbozole. Addition of electron-withdrawing groups such as amines and aldehydes interfere with the catalyst and catalyst activator in the alkyne metathesis reaction. The cage molecule was tested for performance in a dye-sensitized solar cell and compared with the performance of a porphyrin molecule not in this cage. Through the work done in this project, a definitive process forming a cage molecule was developed and refined, and since cage molecules are useful in many applications, the research done in this project is relevant to other fields of study as well as furthering research on organic solar cells.