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Studies of Optical and Electronic Properties of Nanoparticles for Solar Energy Conversion

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Abstract

The higher energy needs for today's technological society requires sustainable and renewable energy source, such as solar energy. This study focuses on using semiconducting quantum dots and fluorescent dyes as light absorbers for solar energy conversion devices such as solar cells. Quantum dots are small nanocrystals (usually 2-10 nm in diameter) with tunable absorbing properties. The smaller the dot, the shorter the wavelength being absorbed. Quantum dots are extremely efficient light absorbers and emitters. Fluorescent dyes have a high quantum yield. In order to examine the energy conversion, cadmium selenide (CdSe) quantum dots and Rhodamine 6G (R6G) dye were spin coated onto graphene (two dimensional nanomaterial). The Kish graphene is mechanically exfoliated to produce graphene. The graphene is then placed onto SiO_2/Si substrate. The number of graphene layers present was estimated through a fluorescence microscope. Lifetime measurements were carried out through time resolved photoluminescence. Trials were conducted with rhodamine 6G both with and without the presence of graphene flakes. Lifetime was found to decrease when rhodamine 6G was placed over the graphene flakes, which is indicative of energy transfer. Lifetime studies of cadmium selenide quantum dot films were also conducted. Tests will continue to determine the effects of cadmium selenide quantum dots placed on top of graphene. Comparisons and analyzation will between the lifetimes of these two materials on graphene will then be determined. These studies will contribute to the ongoing research towards the understanding of energy conversion.

Key Words

Graphene, energy conversion, quantum dots, fluorescence