

عنوان مقاله:

Strategies to Improve Photovoltaic Performance of "Green" CuInS₂ Quantum Dots

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خلاصه مقاله:

While nanocrystals in group II-IV semiconductors have been extensively studied as photosensitizers in quantum dot-sensitized solar cells (QDSCs), their practical use is severely hampered by the high toxicity of the heavy metals, like Cd, Pb, and Hg, present in these semiconductors. Our present work is based on a proposition to use a "green" alternative to the currently used sensitizers, namely CuInS₂ which is a low-toxic semiconductor. However, as for many other types of QDs, surface defects limit also their photovoltaic performance. Therefore, in order to passivate the surface defects and improve the performance of CuInS₂ QDs we explore in this work two strategies - ZnS shell coating and hybrid passivation. The results show that although ZnS shell coating can effectively passivate the surface defects, the electron injection from QDs to TiO₂ nanoparticle is also hampered. Moreover, the size of CuInS₂ QDs is increased after the shell coating, which also is unfavorable for the enhancement of the solar cells efficiency. In contrast, hybrid passivation can passivate the surface defects on the CuInS₂ QDs without size changing, and can increase the loading efficiency of the QDs simultaneously. Consequently, the efficiency of the solar cells is improved to ۴.۷%, which is a promising result for the green CuInS₂ based QDSCs. Therefore, in addition to the most used shell coatings of CuInS₂ QDs, hybrid passivation may be an effective way for improving their photovoltaic performance. This study employs two strategies "hybrid passivation and ZnS shell coating" and discuss about their effect in solar cell efficiency

کلمات کلیدی:

Colloidal quantum dot, Synthesis, Sensitized solar cell, Passivation

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