



High-Efficiency Luminescent Solar Concentrator using superposing of Graphene Quantum Dots

L. Asadi¹, M. Dolatyari², A. Rostami^{1,2}, S. Matloub³ and R. Yadipour⁴

Abstract

Over the last decade, there has been a great need for solar cell-based energy resources due to the effects of greenhouse gases and the high price of fossil fuels. Luminescent Solar Concentrators (LSCs) are an attractive alternative solar energy harvester, offer a novel approach for the utilization of solar irradiation, and increase photovoltaic cell efficiency. In this paper, a novel method is proposed and evaluated theoretically to enhance the efficiency of LSCs. For the implementation of the idea, superimposed quantum dots are used. LSCs doped with graphene quantum dots (GQDs) and Nd-doped GQDs for the first time to show the effectiveness of superimposed QDs. The Monte Carlo ray tracing is employed to evaluate the proposal structure. The proposed LSC prototype device demonstrates many advantages, such as a wide absorption spectrum over the entire visible spectral region, high efficiency of up to 9%, and acceptable transparency. We anticipate our high-efficiency LSC prototype device based on GQDs will shed light on near-future research of LSCs and transparent solar harvesting devices.

Keywords: *Monte Carlo, superimposed quantum dots, Luminescent solar concentrator*