Optical Properties of CdSe Quantum Dots via Non-TOP based Route

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This work reports on the refractive index and permittivity of cadmium selenide quantum dots (CdSe QDs) synthesized without the use of trioctylphosphine (TOP). The transmittance, reflectance, extinction coefficient and permittivity values increase with QDs’ size. The refractive index is about 2.64 for CdSe QDs with crystallite sizes between 2.1-4.1 nm. The refractive index and absorbance is dependent on the real and imaginary parts of the dielectric constant respectively. The forbidden direct, allowed indirect and forbidden indirect band gap transitions are not present in the CdSe QDs synthesized via non-TOP based route.

Keywords: Semiconductors; nanostructures; chemical synthesis; optical properties

1. INTRODUCTION

Among the various kinds of semiconductor nanoparticles, CdSe colloidal nanoparticles are most widely investigated as their emissions can be easily tuned to cover from red to blue with decreasing nanoparticle size [1]. As II-VI semiconductor nanoparticles, CdSe QDs exhibit strong confinement of excited electrons and holes, which leads to dramatically different optical and electronic properties compared to bulk CdSe [2]. Many studies were devoted to CdSe QDs due to their high luminescence quantum yield, narrow band gap and a variety of optoelectronic conversion properties compared to bulk CdSe [3, 4]. In light of this, photoluminescence (PL) and UV-visible absorption has been one of the most important measurements to investigate the optical properties of CdSe QDs [5]. In addition, considerable progress has been made in the synthesis of CdSe QDs to produce CdSe QDs with excellent optical properties [6, 7]. Most of the techniques employed trioctylphosphine (TOP) based systems, in which the reagents are injected into a hot coordinating solvent at elevated