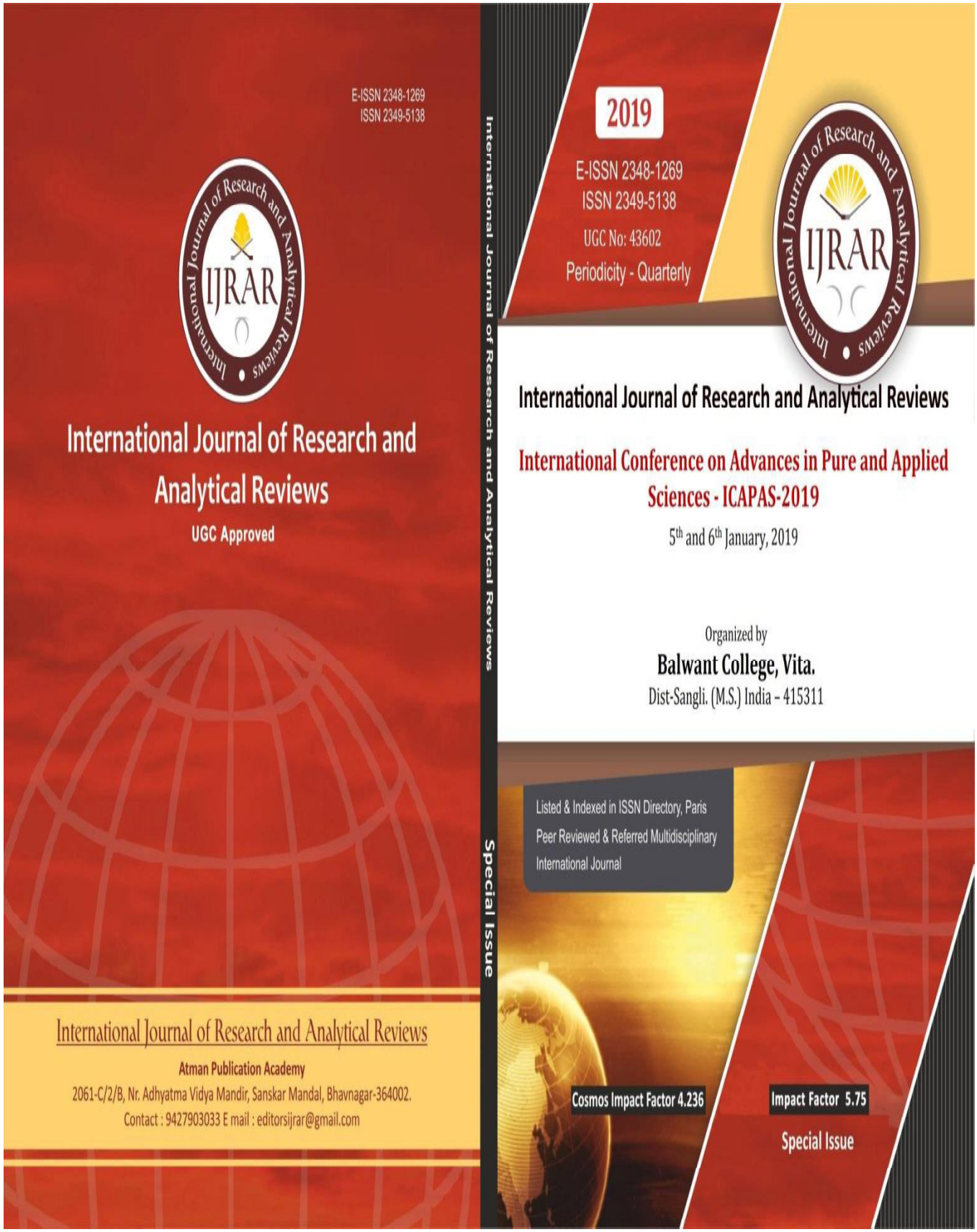
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Studies On Consequence Of Temperature On Physical Properties Of CdSe Thin Films Synthesized Using Chemical Bath Deposition Method

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ABSTRACT: *Chemical bath deposition (CBD) method is the most easy, low-cost and appropriate method for synthesis of compound semiconductors. Present work discusses synthesis of cadmium selenide (CdSe) thin films on stainless steel (SS) and fluorine doped tin oxide coated glass substrates by a facile chemisynthesis route. Cadmium sulfate was used as source of cations while sodiumselenosulfate was used as source of anions. Various synthesis parameters are optimized so as to obtain the best photoactive deposit. The effect of deposition temperature on structural, optical and morphological properties was studied. Thin film samples deposited at various temperatures are characterized using X-ray diffraction, field emission scanning electron microscopy (FE-SEM) and contact angle measurement techniques. Structural study reveals presence of mixed crystal structure. Wettability study reveals increase in hydrophilic nature with increase in deposition temperature.*

Keywords: *CdSe, chemical bath deposition, temperature, Photoelectrochemical, FE-SEM, Wettability studies.*

1. Introduction

Since last few decades compound semiconductors of II-VI group have fascinated a great extent of attention because of their all-embracing applications [1, 2]. Among various semiconductors, Cadmium selenide (CdSe) is one of renowned II-VI group semiconductors, which has awestruck global researchers on account of appropriate properties. CdSe nanocrystals exhibit attractive properties like quantum size effect [3]. A suitable band gap energy of CdSe (Eg = 1.7eV) makes it more approving for various applications as laser diodes, light emitting diodes, optical sensing agents, photoelectrochemical solar cells, photodetectors, photoelectric applications etc [4-6]. Researchers employed number of deposition methods such as vacuum evaporation, successive ionic layer adsorption and reaction, spray pyrolysis, electrode position, pulse plating, chemical bath deposition to grow CdSe thin films [7-10]. Among various methods, chemical bath deposition (CBD) is one of the most suitable deposition methods with no requisite of sophisticated instrumentation. Chemical deposition is simple, economical method which is suitable for large area deposition. In CBD, deposition takes place when ionic product just goes above solubility product [11]. Various deposition parameters like precursor concentrations, deposition time, pH of solution, temperature etc strongly control growth rate of the deposition [12]. Temperature is one of the most important factors that affect growth of grains. One of the consequences of higher deposition temperature is increased crystal size in the thin film. Temperature of deposition bath plays vital role in deciding the physical properties of deposit [13]. Thus present investigation discusses the influence of bath temperature on physical properties of CdSe thin films.

2. Experimental details

2.1 Deposition of CdSe thin films

The CdSe thin films were deposited on the clean stainless steel substrates. As contaminated substrate results into nonuniform deposit thus all the substrates were cleaned by procedure reported elsewhere [9]. All the chemicals used were analytical reagent grade and used without any purification. Cadmium sulfate ($CdSO_4$) was used as sources of cation and sodium selenosulphate (Na_2SeSO_3) was used as anion. Further cadmium cations were complexed using 30 vol.% liquor ammonia. Preparation of Sodium selenosulphate solution was done by procedure reported elsewhere [14]. The preparative parameters were optimized with several trials and by well known photoelectrochemical method [15].

For chemical depositon of CdSe thin films, 10ml solution of 0.05 M $CdSO_4$ was taken into a beaker of 30ml capacity. Liquor ammonia was added drop by drop under constant stirring condition. Initially addition of ammonia to cadmium precursor solution results into formation of milky precipitate of cadmium hydroxide $Cd(OH)_2$, which completely dissolves subsequent to further addition of ammonia solution. Finally,