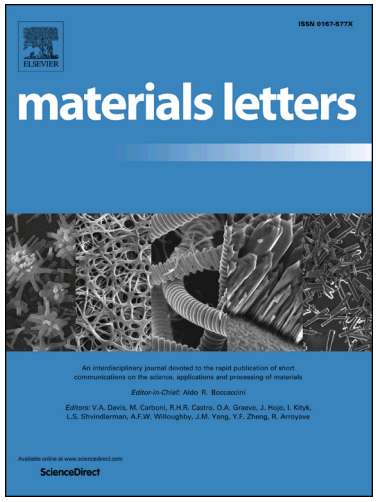


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# Influence of heat treatment on the properties of thermally evaporated Copper Selenide thin films

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## Abstract

A facile thermal evaporation is utilized to deposit copper selenide thin films at different substrate temperatures ($T_s$). Impact of substrate temperature on the film structure, morphology, optical and electrical properties was investigated. Structural transformation from orthorhombic to cubic phase with different stoichiometric compositions is evident upon an increase in substrate temperature. Film morphology demonstrates various shapes from scattered grains to columnar crystals upon heat treatment. The optical analysis illustrates strong absorption in the blue region and the band gap values lies in the range 1.54 eV-2.54 eV. The electrical resistivity was found to be in the order of $10^{-4}$ Ω cm.

Keywords: Copper Selenide, Substrate temperature, Phase change

## 1 Introduction

Copper selenide is a widely investigated and important p-type I-VI semiconductor utilized in the industry of photovoltaic cells, gas sensors and thermoelectric converters [1–3]. The low cost and admirable bandgap of 1.3 to 2.7 eV with high absorption coefficient have attained much interest of researchers across the globe for various applications. Copper selenide exists in various phases with different stoichiometric compositions such as CuSe, $Cu_2Se$, $CuSe_2$, $Cu_7Se_4$, $Cu_5Se_4$, $Cu_3Se_4$ and non-stoichiometric $Cu_{2-x}Se$ [4–6]. It can be constructed into different crystal forms cubic, tetragonal, hexagonal, monoclinic and orthorhombic [7]. On the other side, the abundance of composition and a base material for chalcogenide structures ($Cu_2ZnSnSe$,