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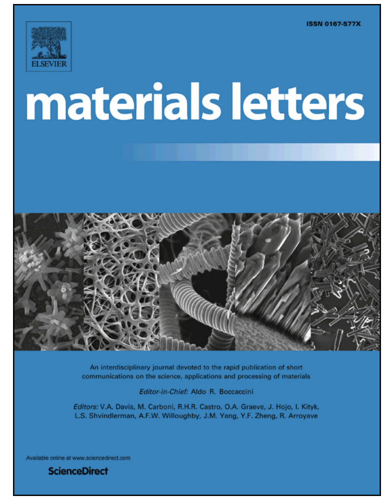

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THERMO ELECTRIC MEASUREMENT OF NANOCRYSTALLINE COBALT DOPED COPPER SULFIDE FOR ENERGY GENERATION

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Abstract: Submicron crystallites of CuS and Co doped CuS have been prepared by hydrothermal route**.** The structure of prepared crystallites were found to be hexagonal shape with space group $P6_3/mmc$ and the size of the crystallites is in the range 89-127 nm. The morphology of the prepared CuS is nanoflower and there is no change in the morphology with cobalt doping. The d spacing and the cell parameters of the crystallites is found to be decreasing with doping of cobalt. The samples are pressed into pellets and their thermoelectric properties were investigated. CuS has an exothermic peak at 390K as obtained in Differential Scanning Calorimetry (DSC) analysis so the electrical and thermal properties of all bulk samples were measured from 310 K to 370 K to avoid the phase change. The pure CuS samples prepared via hydrothermal synthesis reached the highest thermoelectric figure of merit (ZT) of 5.45×10^{-3} at 362 K and for the $Cu_{1.6}Co_{0.4}S$ the ZT value is increased to 8.3 $\times10^{-3}$ at 362K.

Keywords: Metal sulfides, Thermoelectricity, Power factor, Figure of Merit

Introduction:

Thermo electric system is an environment friendly, non-mechanical energy conversion technology with no pollution, wide temperature range application and small size. Among thermo electric materials metal sulfides have more importance due to their abundance and low toxicity [1]. The efficiency of thermoelectric devices is primarily governed by three interrelated material parameters: the electrical conductivity (σ), the Seebeck coefficient or thermo power(S), and the thermal conductivity (κ). These parameters are grouped into a single parameter used to characterize the ability of a material to convert heat to electrical energy as a dimensionless figure of merit ZT, defined as

$$ZT = \frac{\sigma S^2}{\kappa_{l} + \kappa_e} T$$

Where T is the absolute temperature. Current thermoelectric materials struggle to simultaneously display high σ and S, and low κ, which prevents their widespread implementation. The numerator of the equation $S^2\sigma$ known as power factor should be increased and the electronic and lattice thermal conductivity κ_e and κ_l, should be decreased to increase the value of figure of merit. As these transport characteristics are correlated with each other, obtaining a high ZT is a tiresome work. In recent years, employing band engineering and nanostructuring enhance the ZT value of thermoelectric materials [2].