Abstract No: 119 ***Physical Sciences***

THE ENHANCEMENT OF THERMOELECTRIC PROPERTIES OF COPPER IODIDE THROUGH DOPING

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Thermoelectricity generation, the direct conversion of thermal energy into electricity, is emerging as an efficient waste heat recovery technique and renewable energy harvesting method. Thermoelectricity generation can also be utilized to improve the energy efficiency of devices. The efficiency of thermoelectricity generation depends on the electrical and thermal properties of the thermoelectric materials (TEMs) in the device. TEMs should exhibit high Seebeck coefficients, excellent electrical conductivities, and minimal thermal conductivities for optimal performance. The use of expensive, hazardous, and rare TEMs such as tellurium has hampered the widespread adoption of this technology. Moreover, while numerous n-type thermoelectric materials exist, the availability of suitable p-type materials is limited. Consequently, this study focuses on improving the thermoelectric properties of p-type CuI by means of KI doping. Undoped and KI-doped CuI powders were pressed into pellets to make thermoelectric generators. A 5% KI doping significantly improved the thermoelectric parameters such as electrical conductivity, Seebeck coefficient, and generated power of the thermoelectric generators. The electrical conductivity of CuI increased from 0.256 S m^{-1} to 3.329 S m^{-1}, while the Seebeck coefficient of CuI increased from 535.6 V K^{-1} to 6968.8 V K^{-1} due to the KI doping. As expected, thermal conductivity decreased with the doping. At 373 K thermal conductivity of the CuI pellet is 1.51 W m^{-1} $K^{-1,}$ while that of KI-doped sample is 1.10 W m^{-1} K^{-1}. The highest Seebeck coefficient of 7061.74 V K^{-1} was observed at the average temperature of 379 K. The generated power in the doped system was 8.24 W at 384 K. The study concludes that 5% KI doping improves the electrical conductivity and Seebeck coefficient of CuI while thermal conductivity decreases, making KI-doped CuI an efficient TEM. At 373 K, the generated power of the doped CuI significantly increased from 0.04 W to 6.15 W due to KI doping.

Financial assistance from the University of Peradeniya grants and the Postgraduate Institute of Science (PGIS) (*Grant No PGIS/2022/04 and URG/2022/58/S*) *is acknowledged.*

Keywords: Copper Iodide, Figure of merit, Generated power, Seebeck effect, Thermoelectricity