Thermal Transport Properties of TlInTe$_2$ Single Crystals

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Abstract. Thallium indium ditelluride single crystal, was prepared by a special design constructed by our group. A brass working chamber designed for measuring (TEP) in a wide range of temperature was used. The experimental results indicates that TlInTe$_2$ is of p-type conductivity. The mobility of charge carriers, holes and electrons was found to be $2.129 \times 10^3$ cm$^2$/V sec and $1.218 \times 10^5$ cm$^2$/V sec respectively. The effective masses of the majority and minority carriers were deduced to be $5.367 \times 10^{-37}$ kg and $6.856 \times 10^{-43}$ kg respectively. The diffusion coefficient, relaxation time and diffusion length for holes was calculated to be $551.436$ cm$^2$/sec, $7.142 \times 10^{-21}$ sec and $1.986 \times 10^{-9}$ cm respectively. Also $D_n$, $\tau_n$, $L_n$ for the electrons was calculated to be $3.156 \times 10^3$ cm$^3$/sec, $5.222 \times 10^{-26}$ sec and $1.284 \times 10^{-11}$ cm respectively. In addition to these pronounced parameters, the efficiency of the thermoelectric element (figure of merit) was evaluated, which leads to better application in many fields.

Keywords: TlInTe$_2$, single crystals, thermoelectric power, semiconductor, charge carriers.