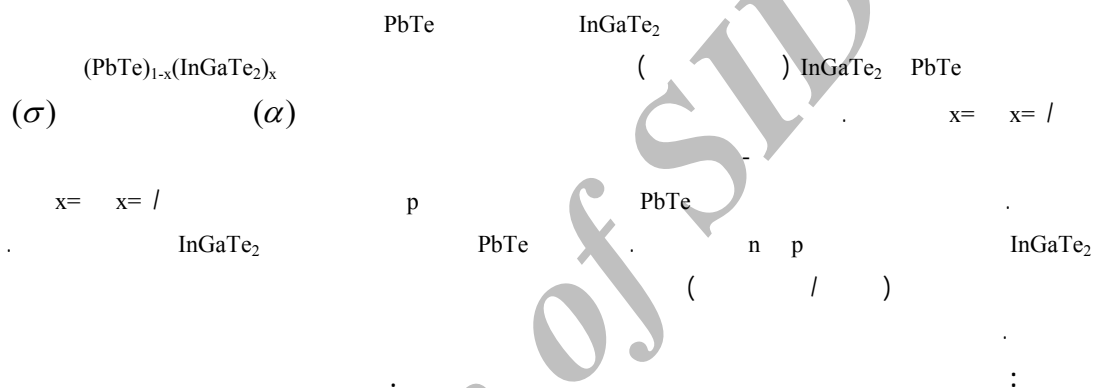


(-)K

x= x= /



Study of Some Electric and Thermoelectric Properties of the Composition $(\text{PbTe})_{1-x}(\text{InGaTe}_2)_x$ for Two Different Mole Percentages of $x=0.5$ and $x=1$, in the Temperature Range (100-400) K

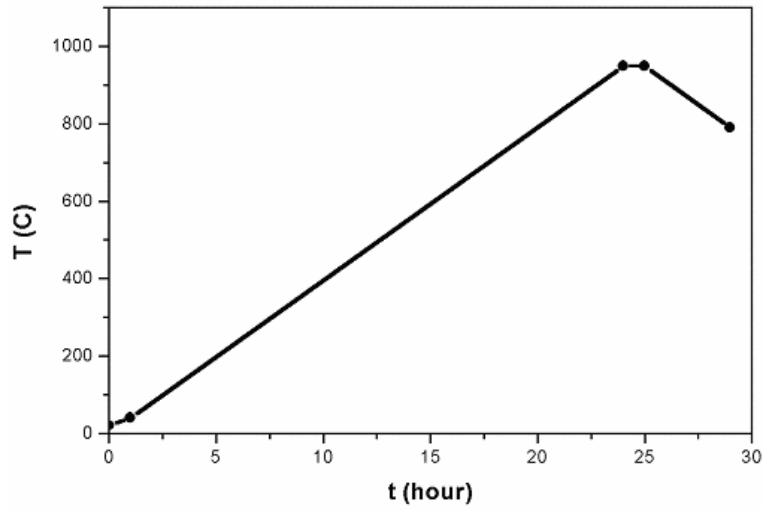
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Abstract

In this experimental work, the polycrystalline samples of ternary compound InGaTe_2 and binary compound PbTe were initially synthesized and then by grinding and mixing given amounts of PbTe and InGaTe_2 (as impurity), two types of compounds given by the formula $(\text{PbTe})_{1-x}(\text{InGaTe}_2)_x$ having two different mole percentages of $x=0.5$ and $x=1$ were synthesized, respectively. By studying the variations of thermoelectric power (α) and electrical conductivity (σ) of samples versus the temperature, the values of energy gap for the above two compounds were evaluated. Experimental results show that, the pure PbTe is a typical p type semiconductor, but introducing the ternary compound InGaTe_2 into the crystal, its conductivity changes from p to n. The energy gap of PbTe is increased by increasing the mole percentage of the InGaTe_2 impurity. Increasing the impurity content, up to $x=0.5$ mole percent causes the conductivity to increase, but further increase of the impurity content, causes the conductivity to decrease. Thermoelectric power increases with the temperature and its maximum value is larger for the compound with lesser impurity content.

Key words: Polycrystal, Electrical conductivity, Thermoelectric power, Energy gap.



InGaTe₂

(In, Ga, Te)

InGaTe₂

	()	°C

InGaTe₂

()

()

(PbTe)_{1-x}(InGaTe₂)_x

x = /

InGaTe₂ PbTe

()

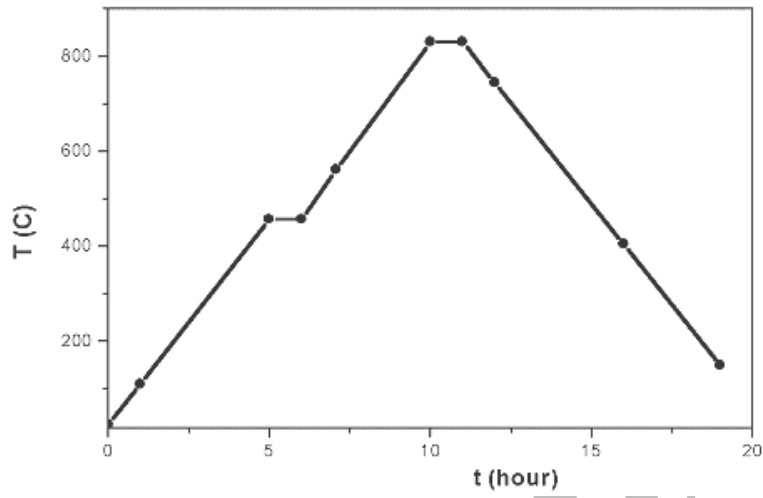
()

()

°C

°C

()



x= (PbTe)_{1-x}(InGaTe₂)_x

x= /

°C

°C

()

(p)

Bi₂Te₃

n

p

(PbTe)_{1-x}(InGaTe₂)_x

x= x= /

n

x= /

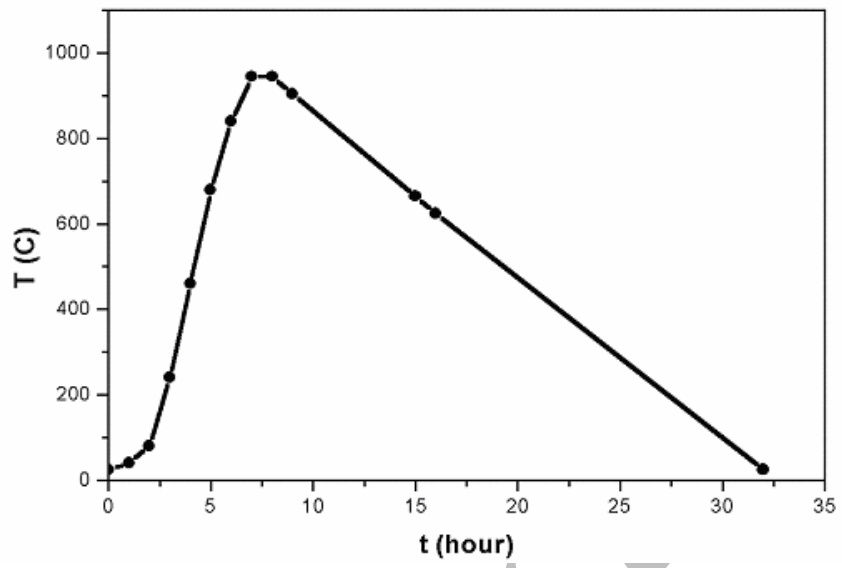
(PbTe)_{1-x}(InGaTe₂)_x

()

°C

	()	°C

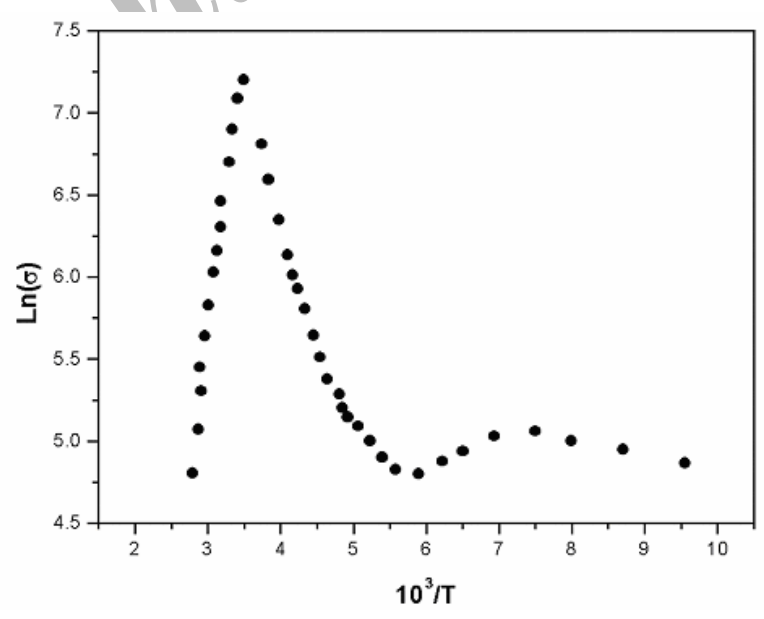
Archive of SID



(σ)

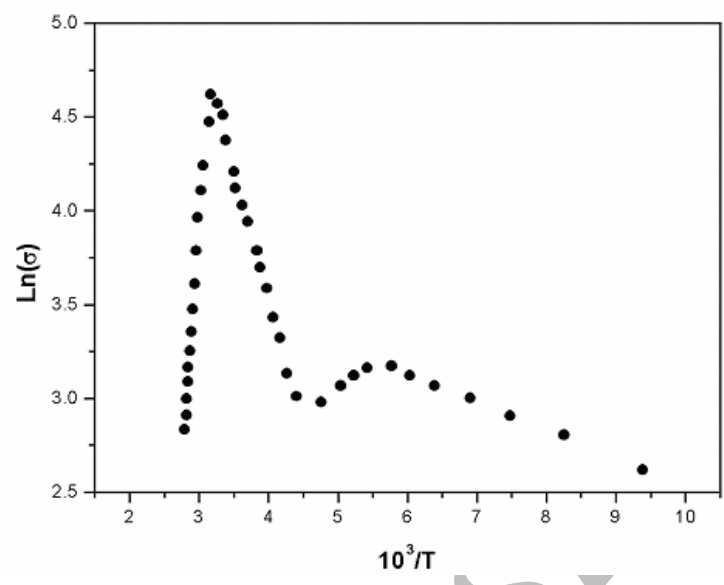
(α)

$\frac{1}{T}$ $\ln \sigma$
 () ()



()

$\frac{1}{T}$ $\ln \sigma$



() $\frac{1}{T}$ $Ln\sigma$ -

() []

() () $\sigma = \sigma_0 \exp(-\frac{\epsilon_g}{2k_B T})$ $\exp(-\frac{\epsilon_g}{2k_B T})$

() $\frac{1}{T}$ $Ln\sigma$ $T^{3/2}$ σ_0 ϵ_g

$T = 173K$ () $T = 133K$

$\exp(-\frac{\epsilon_g}{2k_B T})$ $T^{3/2}$ (

()

: ()

$$\begin{aligned} \varepsilon_{g1} &= 0.34eV, \varepsilon_{d1} = 0.028eV, \\ \varepsilon_{g2} &= 0.38eV, \varepsilon_{d2} = 0.035eV \end{aligned}$$

()

()

$$T = (133 - 170)K^\circ$$

$$T = (173 - 222)K$$

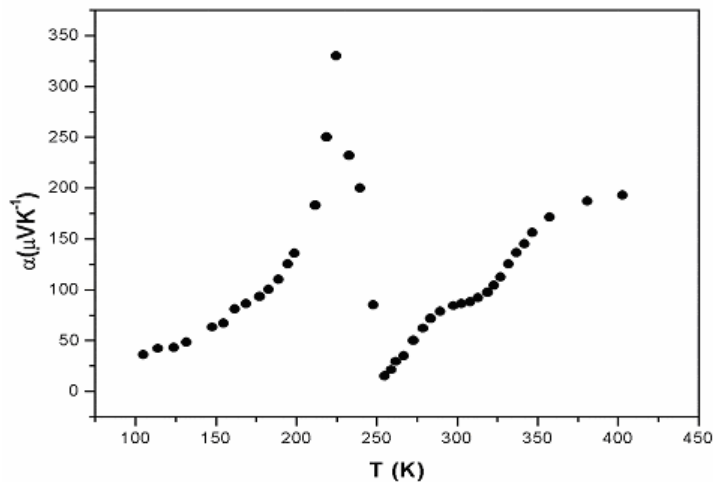
()

$$T = 222^\circ K \quad ()$$

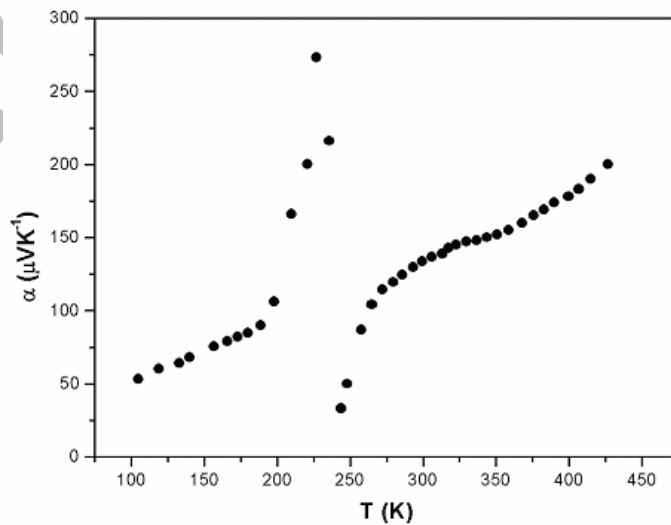
$$T = 170^\circ K$$

()

() ()



() T α -



() T α -

()

$$\left(\alpha = \frac{\Delta E}{\Delta T}\right)$$

α

ΔE

ΔE

α

α

ΔE

α

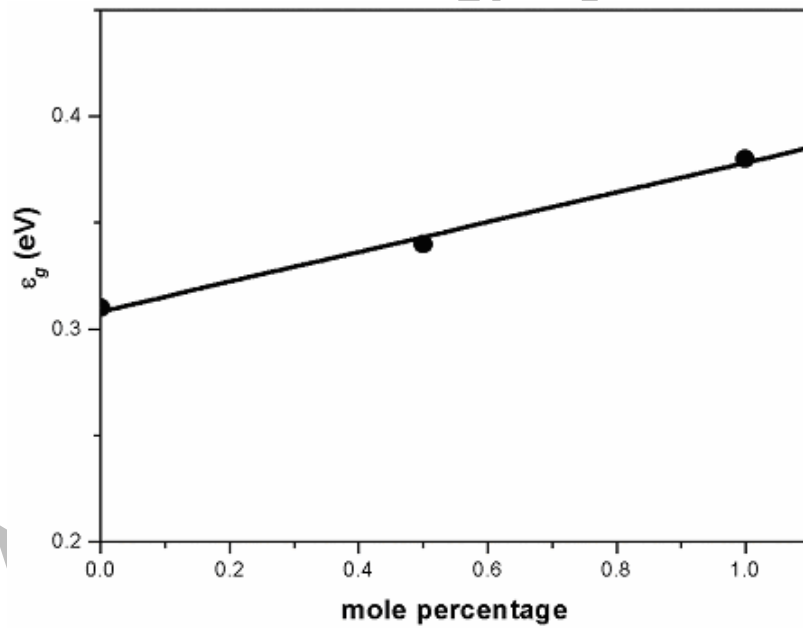
() ()

T

α

()

()



ϵ_g

$x =$

$\Omega^{-1} Cm^{-1}$

PbTe

InGaTe₂

PbTe

$x =$

()

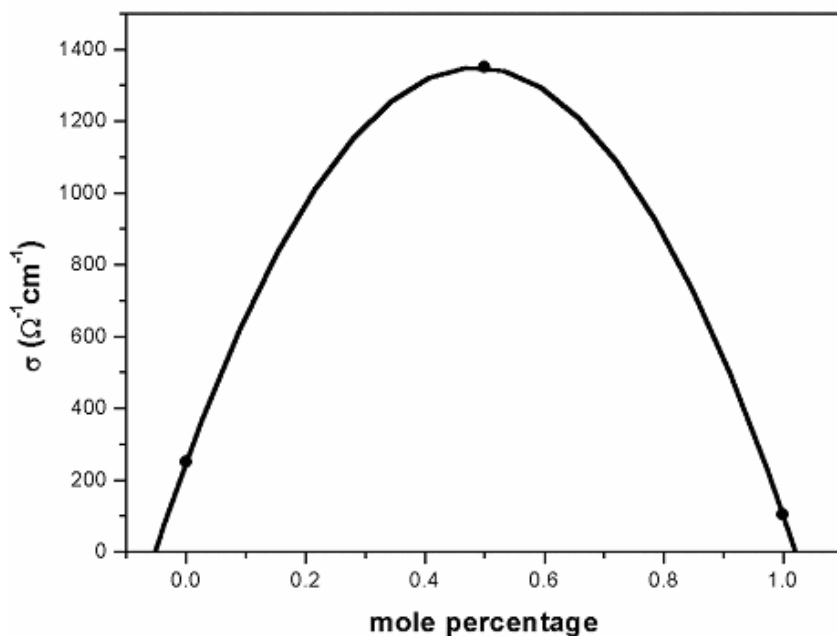
$\Omega^{-1} Cm^{-1}$

()

$x = /$

()

$\Omega^{-1} Cm^{-1}$



α

σ

() ()

PbTe InGaTe₂

()

n p
InGaTe₂

PbTe

PbTe

PbTe

() ()

/ eV / eV

/ eV

()

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