STRUCTURAL AND MORPHOLOGICAL PROPERTIES OF ELECTRODEPOSITED BISMUTH TELLURIDE (Bi_2Te_3)THIN FILMS

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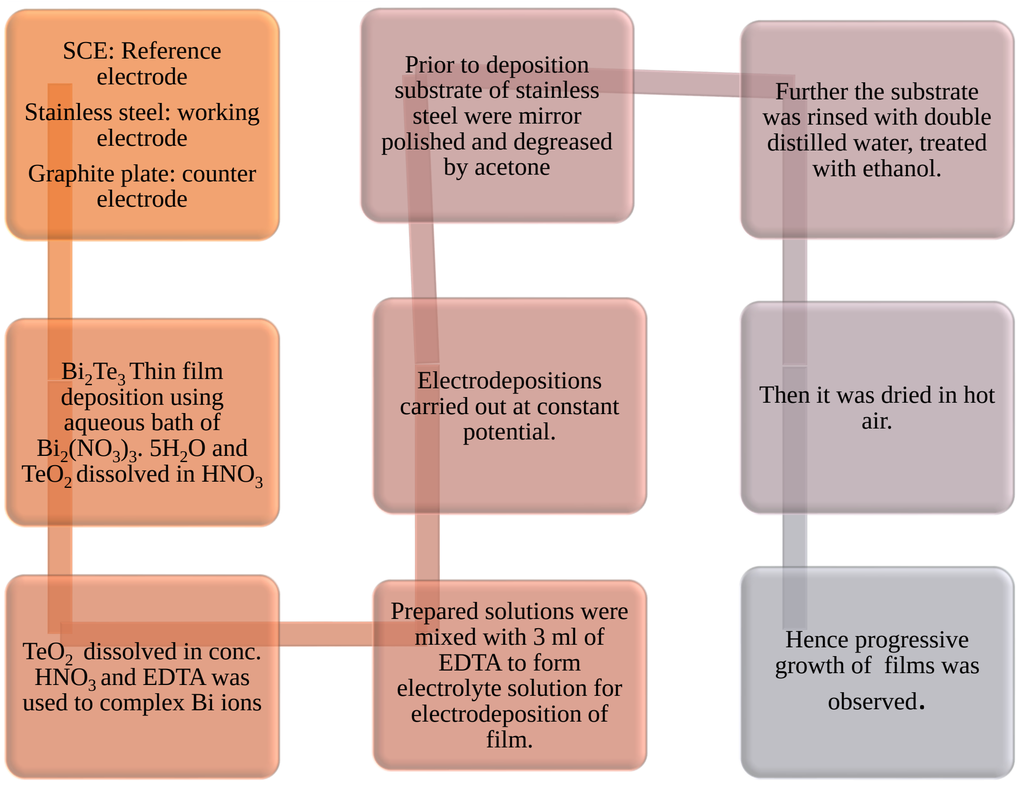
ABSTRACT:

Present work deals with the electrodeposition of Bi_2Te_3 thin films. Structural , elemental and morphological analysis of deposited films have been caused out using XRD and SEM with EDXS technique. XRD confirms the formation of Bi_2Te_3 crystals with crystalline size in the range of 5 to 9 nm . EDXs is in agreement with X-Ray diffractometer and confirms the qualitative formation of Bi_2Te_3 in stoichiometry of 2:3. Scanning electron micrograph reveals the uniform spherical morphology for the deposited films.

INTRODUCTION:

Bismuth telluride is attractive material due to its efficiency of conversion of heat into electricity [1]. Currently, bunch of research is going on to improve the efficiency of thermoelectric materials by the development of Bi_2Te_3 nanostructure. Bi_2Te_3 is basically considered as a compound element of bismuth and tellurium when bismuth is alloyed with tellurium, then it behaves as a well organised semiconductor thermoelectric type material[2]. It is used for some applications like cooler thermoelectric refrigeration, thermal sensor, TEG, etc[3]. In this sense, in present work attempt is made for preparation of Bismuth telluride thin films by electrodeposition technique. Preparative parameter like deposition time, thickness of films, deposition potential, are optimized. Thin film of Bi_2Te_3 is characterized by XRD, SEM, EDAX.

EXPERIMENTAL DETAILS:



SEM STUDIES OF Bi_2Te_3 THIN FILM:

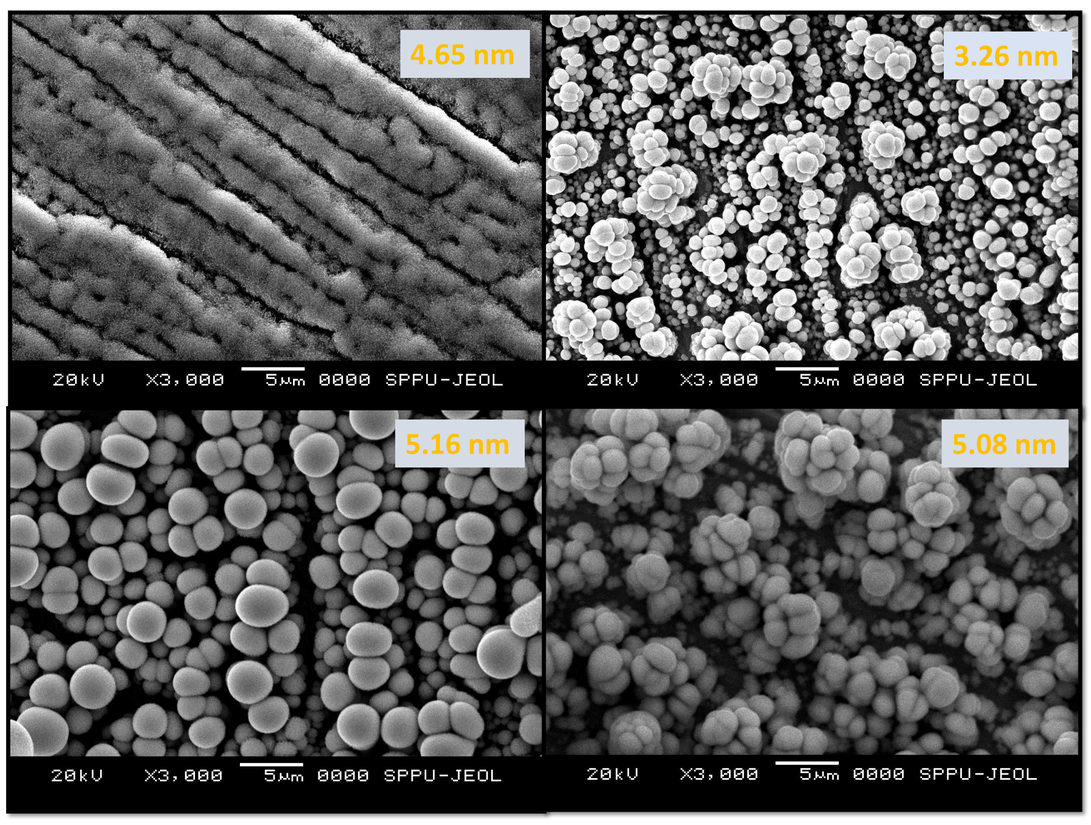


FIGURE: SCANNING ELECTRON MICROGRAPH OF THE DEPOSITED Bi_2Te_3 THIN FILM

Time [min]	2 theta [°]	Crystal size [nm]	Microstrain $\varepsilon=\beta\cos\theta/4$ (10^{-4} lin^{-2} m^{-4})	Dislocation density $\delta = 15\,\varepsilon/aD$ (10^{14} lin/m^2)
20	27.72	4.65	77.82	573.08
30	27.58	3.26	111.07	1167.33
40	27.70	5.16	70.07	464.63
50	27.56	5.08	71.24	480.21

TABLE : CHARACTERISTICS OF DEPOSITED FILMS

WORKING PRINCIPLE:

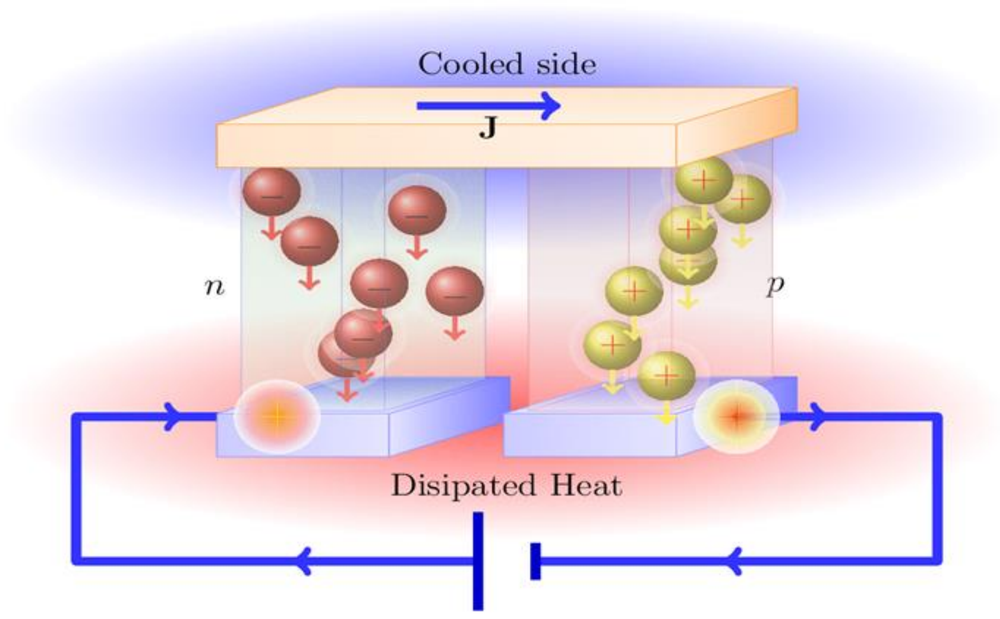


FIGURE: PELTIER EFFECT IN THERMOELECTRICS

RESULTS AND DISCUSSION:

- **XRD ANALYSIS:**

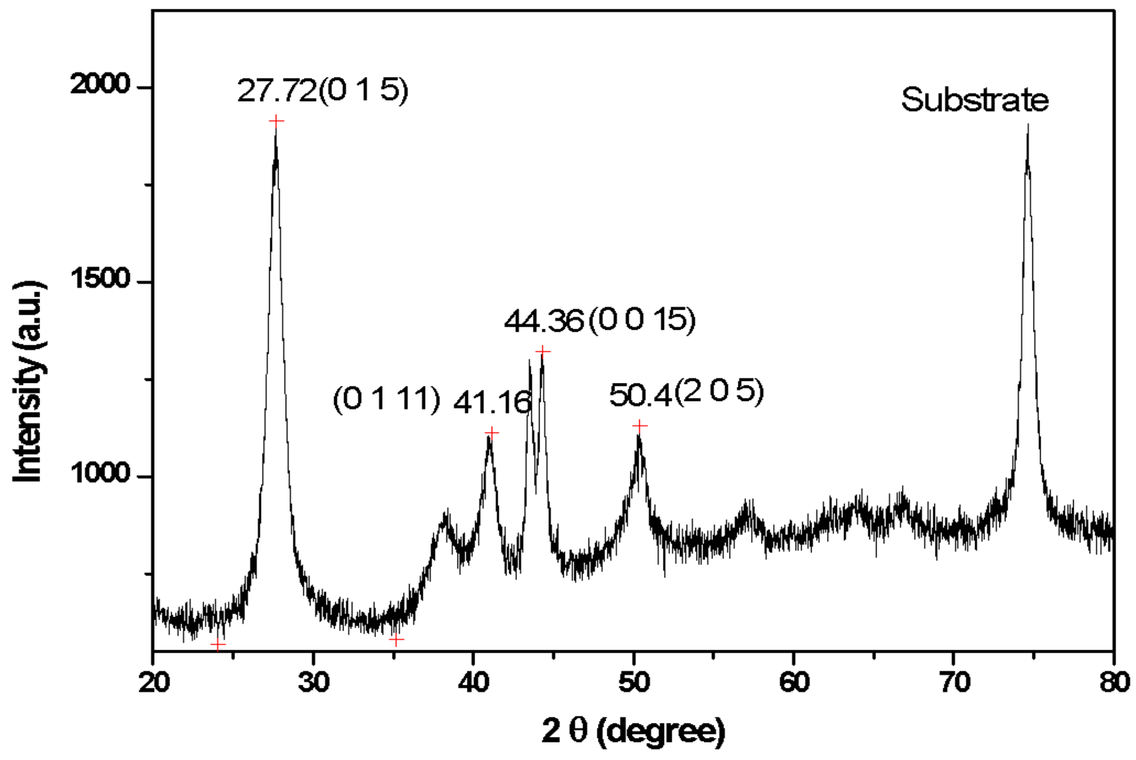


FIGURE: X-RAY PATTERN OF Bi_2Te_3 THIN FILM.

EDAX ANALYSIS:

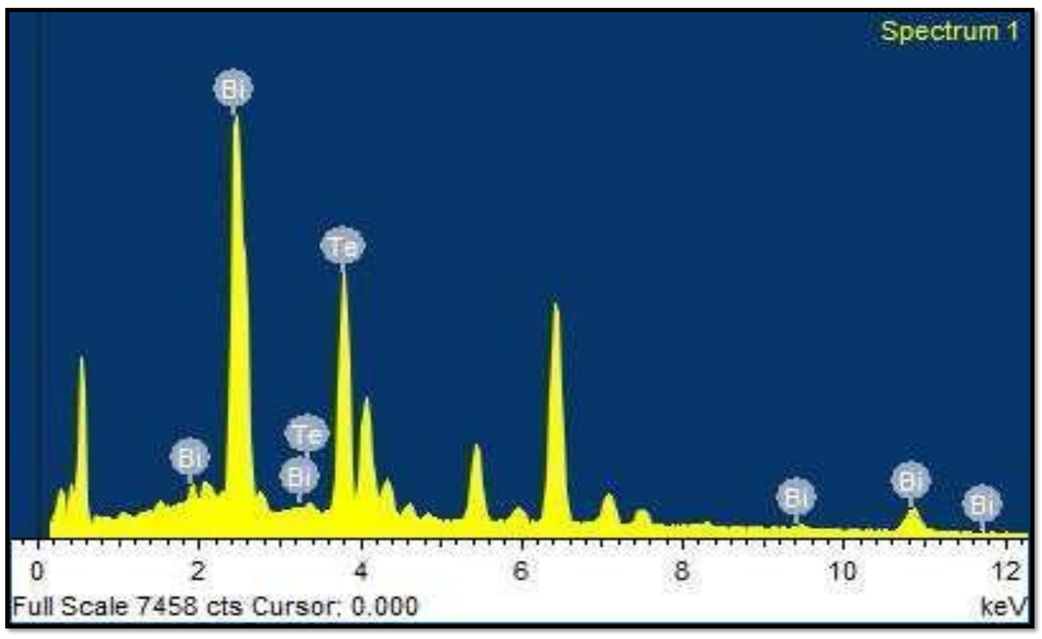


FIGURE: ELEMENTAL ANALYSIS OF Bi_2Te_3 THIN FILMS

CONCLUSION:

- Successful deposition of Bi_2Te_3 is observed.
- XRD reveals Rhombohedral structure of deposited films, the crystal size observed was between 3.26 nm to 5.16 nm.
- Elemental analysis qualitatively supports XRD.
- SEM studies declare that thin film of Bi_2Te_3 has marigold/ cauliflower morphology.
- Hence, the work concludes that Bi_2Te_3 thin films are promising for thermoelectric applications.

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