Enhancing M-doped Bi2Te2.7Se0.3 for Thermoelectric Power Generation Using Advanced Pulsed Laser Deposition Technique

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Our planet’s temperature is continuing to rise dangerously due to greenhouse gas emissions from the excessive use of fossil fuels. This is contributing to global warming and forest decline which has negative effect on the environment, humans, animals and plants. To solve this problem, researchers are working hard to develop novel methods for converting waste-heat to electricity by the thermoelectric (TE) method. It is well known that bismuth telluride-based materials are the most effective in this field. However, the main drawback is that it has a low value of the thermoelectric figure of merit (ZT) which is having a value of 0.54 for the bismuth tellurium selenide (BTS) material. In order to improve the ZT value, ternary Cu/Ni/Bi2Te2.7Se0.3 nanocomposite thermoelectric six films were fabricated with different percentages of Cu and Ni using advanced pulsed laser deposition technique (PLD). Pure Bi2Te2.7Se0.3 (BTS), Cu/Bi2Te2.7Se0.3 and Ni/Bi2Te2.7Se0.3 nanocomposites were also synthesized. Morphological and structural characterizations using advanced analytical techniques were applied to study the quality and properties of the films. The ZT value achieved was 0.97 for BTS-2(Cu+Ni) film prepared by our PLD system, while the ZT value obtained for pure BTS was 0.50. This proved that using BTS-2(Cu+Ni) material can convert more electricity from heat than pure BTS film. The novel approach can be used in thermoelectric power generators which may help to reduce air pollution, decelerate climate change, and equally help to generate power from heat.