High-performance Solar Thermoelectric Energy Conversion System with Efficient Thermal Concentration

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The main technical and economic limitations of the traditional Photovoltaic cells are the high cost, low efficiency.The currently used semiconductor materials (Si,Ge) have absorption only in the visible range of the solar spectrum, and they don’t benefit from thermal energy (IR and NIR region). This research aims to design, fabricate and investigate a more promising, cost effective, and highly efficient Solar Thermoelectric Generator (STEG) based on the Seebeck effect .A novel hybrid Nano-structured composite based on (pure Graphene-Oxide and Plasmonic Gold Nano Spheres) has been prepared via “Microwave Irradiation Method”.This Photothermal material has a remarkable ability to absorb solar spectrum in the range from UV(350 nm), and visible light(542 nm) to Near-IR(900-1300 nm) and converts it efficiently into heat. Its optical properties have been recorded via "UV-Vis Spectrophotometer". Comparisons were conducted between Slabs-substrates- of Red copper that were coated with thin films of different thicknesses and ratios of Au&GO nano-composite with adhesive promoter, and anti-corrosive paint using Spray Coating technique.The optimum condition was achieved with 125-150 µm thickness and the ratio between (Au&GO) to (adhesive promoter) is 3 : 2 respectively. Slabs were fixed on the commercial “Bismuth Telluride modules”, as the hot side. The cold side temperature is maintained by a “Heat Sink” with close water cooling circulation. Optical lenses , Reflectors , and Glass enclosure have been fabricated to improve heat concentration and the overall efficiency and performance that have been evaluated. This project opens a new opportunity to be applied in small or large scale applications .

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