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HYDROTHERMAL SYNTHESIS OF HGTE THIN FILMS FOR POSSIBLE APPLICATIONS IN THIN FILM CdTe SOLAR CELLS

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HgTe is a compound semiconductor of the II-VI group with the narrowest direct band gap ranging from 0.2 to 1.2 eV. The material has uses in photodetectors and thin-film solar cells. A simple method for synthesizing pure HgTe powder samples using hydrothermal processes is presented in the current study. In double distilled water (DDW), mercury nitrate and tellurium oxide were used as precursors, along with NaBH₄ as the reducing reagent. The chemicals were mixed at ambient temperature before being placed in an autoclave at 200 °C for 72 hours. Precipitate was dried at 80 °C in a vacuum oven for 12 hours. The obtained solution was washed three times by centrifugation with DDW and ethanol. The optical, structural, and morphological properties of the synthesized powder samples were studied using an X-ray diffractometer, Raman microscopy, scanning electron microscope, and energy dispersive spectroscopy. A highly crystalline pure cubic crystal phase was revealed by XRD analysis. The TO and LO modes observed in Raman spectra at 116 and 137 cm⁻¹ confirmed the formation of HgTe. SEM images showed that the formed agglomerated particle nanoparticles are spherical, uniform, and dense. The elemental composition determined using EDS was found to be 1:1 in stoichiometry. The synthesized material could be utilized to deposit thin films to examine their applications in solar cells and IR detectors.

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Keywords: Hydrothermal synthesis, Mercury tellurides (HgTe), Powder samples, Solar cells