CRYSTALLINE GETE THIN FILMS FOR INFRARED PHOTODETECTION

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Rapid advances in optoelectronic technologies are driving the demand for infrared (IR) photodetectors capable of room-temperature operation while avoiding highly toxic materials and complex cooling requirements. State-of-the-art IR detector technologies based on HgCdTe and InSb remain limited by high cost, material toxicity, and the need for cryogenic operation [1], motivating the exploration of alternative semiconductor platforms. Germanium telluride (GeTe) is a promising candidate owing to its narrow bandgap (0.6 eV), high infrared absorption coefficient, and strong light–matter interaction, which are favorable for thin-film IR photodetection [2]. In addition to its well-known phase-change behavior, crystalline GeTe exhibits optical and electronic properties [3,4] that, combined with its chemical stability and compatibility with standard semiconductor processing, make it an attractive material for infrared optoelectronic applications.

In this work, the focus is placed on establishing and comparing fabrication strategies for crystalline GeTe thin films with controlled stoichiometry and structural quality, as a prerequisite for future device development. Two complementary deposition approaches are explored: rapid thermal evaporation from pre-synthesized GeTe sources and reactive diffusion based on vacuum-deposited Ge/Te multilayer stacks followed by thermal treatment. The resulting thin films are examined using X-ray diffraction, scanning electron microscopy, X-ray photoelectron spectroscopy, and Raman spectroscopy to assess phase formation, compositional uniformity, and microstructural evolution.

By systematically investigating the influence of deposition route and post-deposition processing on film structure and composition, this study aims to clarify process–structure relationships in crystalline GeTe thin films. The outcomes are expected to provide guidance for optimizing GeTe thin-film growth toward infrared optoelectronic applications and to support the longer-term development of room-temperature IR photodetectors based on non-toxic and scalable material systems.

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