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Characterisation of Ge-GeSn superlattices grown by remote plasma enhanced chemical vapor deposition

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Germanium-tin (GeSn) alloys have recently emerged as promising materials for infrared photodetectors due to their tunable bandgap, which ranges from the short-wavelength infrared ($<3\ \mu\text{m}$) to the mid-wavelength infrared ($\sim 3\text{--}10\ \mu\text{m}$). Ge-GeSn superlattices offer further advantages, including enhanced carrier confinement and improved absorption efficiency arising from quantum confinement effects. However, the growth of high-quality GeSn superlattices remains challenging, primarily due to strain management, defect suppression, and precise compositional control. We report here the growth of GeSn-Ge superlattices on Ge substrates using remote plasma enhanced chemical vapor deposition (RPECVD), an advanced technique that enables low-temperature, high-efficiency growth with more than 70% precursor utilization and improved Sn incorporation. The material quality of the films, grown with varying layer thicknesses, was systematically investigated using X-ray diffraction, atomic force microscopy, Rutherford backscattering spectrometry, and advanced transmission electron microscopy. These results highlight a viable pathway toward the fabrication of high-performance GeSn-based mid-infrared photodetectors.

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