Supplemental Information

Epitaxial Growth and Optical Properties of GeSn Alloys on Ge (100) and Si (100) via Molecular Beam Epitaxy

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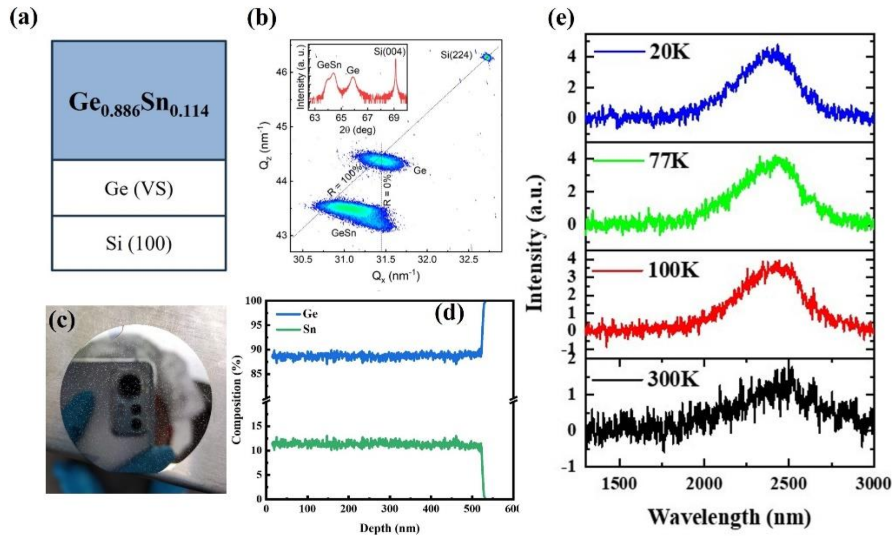

Fig 1. (a) Schematic diagram of GeSn layer (b) 2θ-ω scans and RSMs of GeSn layers with 11.4% Sn content (c) Optical image of 2-inch wafer of GeSn grown on Si (100) substrate (d)SIMS depth profile of Ge and Sn (e) Temperature dependent PL measurements from a GeSn layer with 11.4% Sn content.

High Sn content GeSn strained thin layers, and relaxed layers were successfully grown on Ge (100) substrates using MBE using effusion cells.

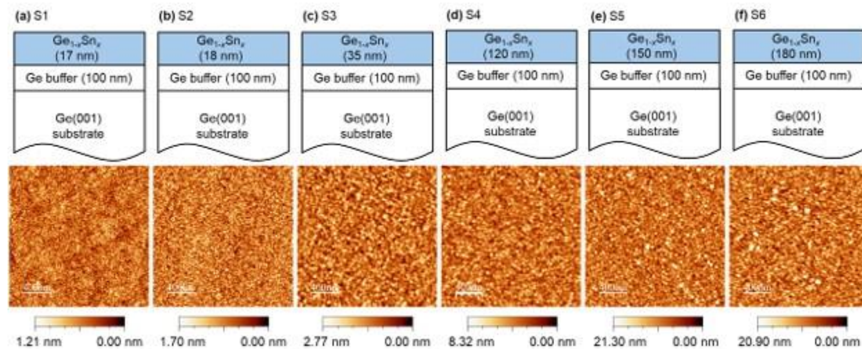

Fig. 2: Top panel: Sample structure of GeSn with varying thicknesses for studying strain relaxation, grown on Ge(001). Bottom panel: Corresponding AFM images

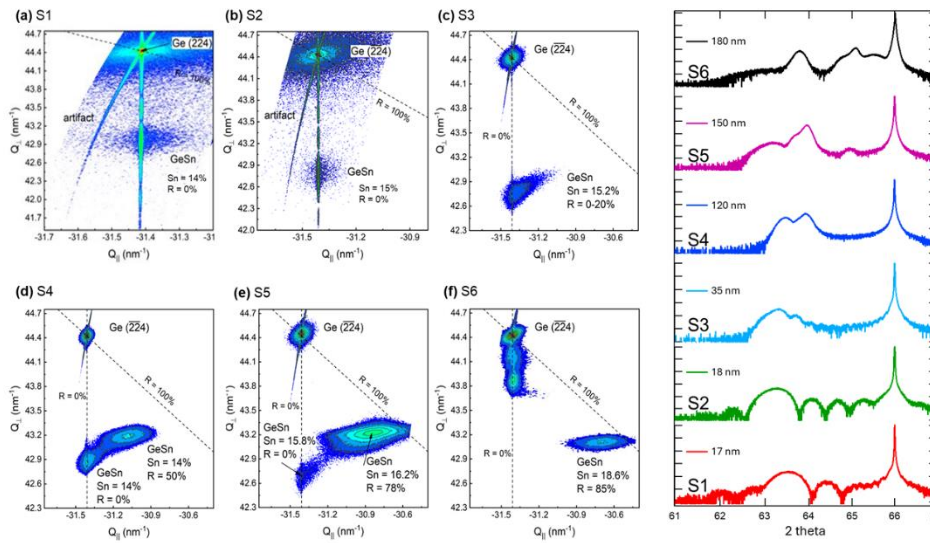

Fig. 3: XRD-RSM study of GeSn near Ge (224), showing different degrees of strain relaxation of the GeSn layers. (a) Sample S1 and (b) sample S2 are fully strained. (c – f) Samples S3 to S6 relaxes from 20 % to 85% with increasing GeSn layer thickness.

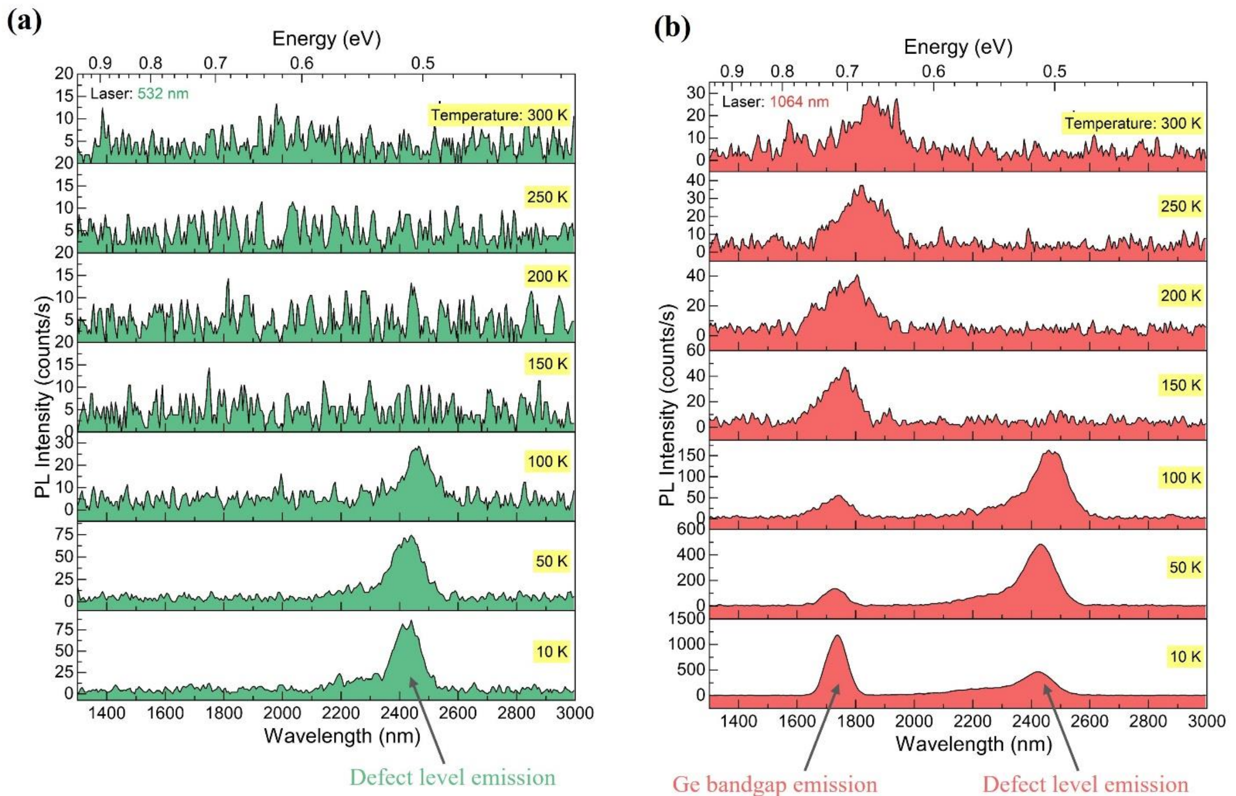

Fig. 4. Temperature dependent PL spectra acquired (a) 532 nm and (b) 1064 nm lasers on GeSn alloy grown in Ge (001) substrate using MBE.