Development of High-Quality SiSn and SiGeSn Alloys for Optoelectronic and Photonic Applications

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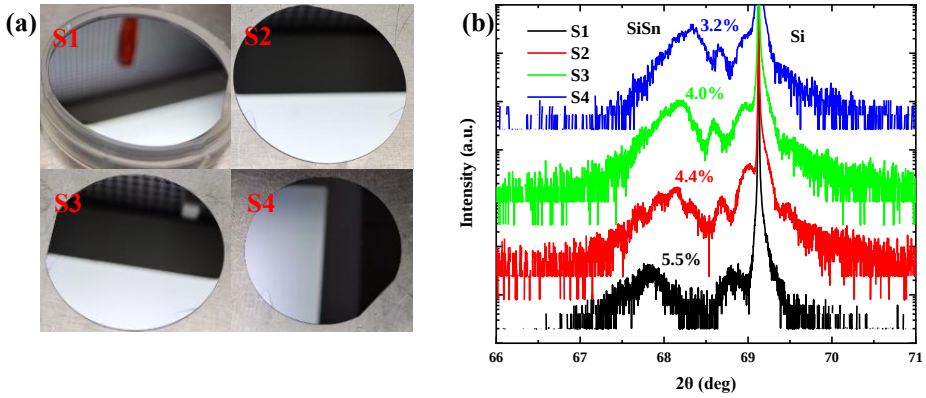

Figure 1. (a) Optical images of SiSn samples. (b) 2θ-ω scan of SiSn samples on Si with different Sn from 3.2% to 5.5%.

Fig. 1 (a) shows the optical images of SiSn samples. All the samples show very shiny surface without any Sn segregation. Fig. 1(b) shows the 2θ-ω scan, clear peaks corresponding to the SiSn alloy can be observed, indicating the good crystalline structure of the SiSn layers.

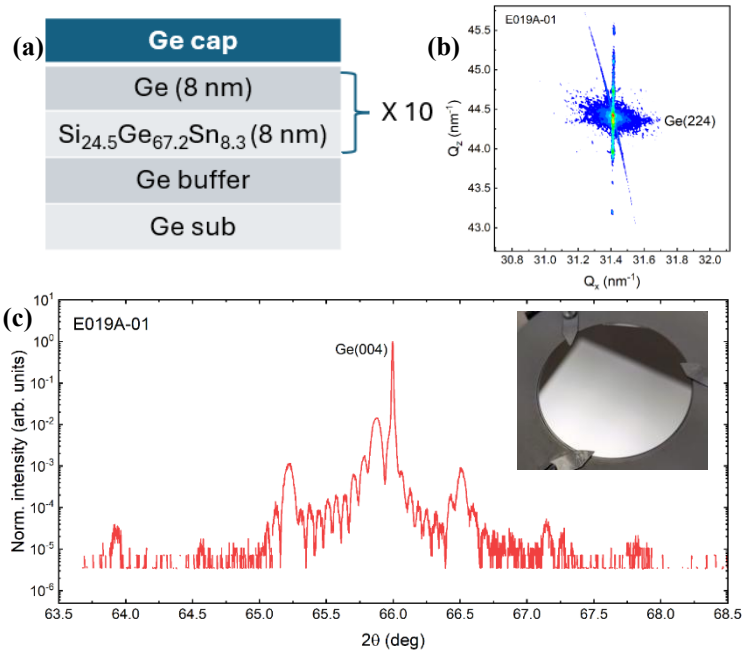

Figure 2. (a) Schematic of the Ge/SiGeSn superlattice structure. (b, c) $(\bar{2}\bar{2}4)$ RSM mapping and 2θ-ω scan of the SLs, the inserted figure shows the optical of the sample.

Fig.2 shows the basic structure information of the SiGeSn/Ge superlattice on Ge. The clear satellite peaks reveal the high quality of the sample and sharp interfaces.

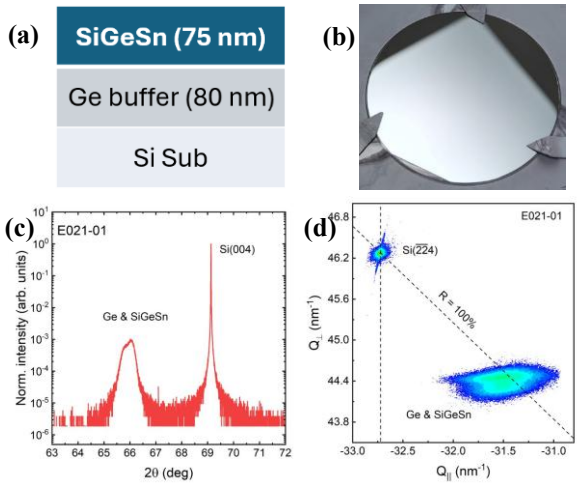

Figure 3. (a, b) Schematic and optical image of SiGeSn on Si (c, d) 2θ-ω scan and $(\bar{2}\bar{2}4)$ RSM mapping of SiGeSn sample.

Fig. 3 shows the SiGeSn bulk material. A shiny surface without any Sn segregation can be observed. RSM and XRD data show a lattice matched to Ge.

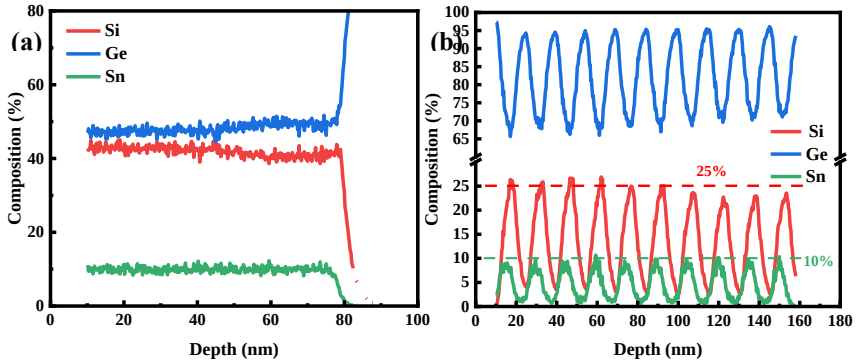

Figure 4. SIMS measurement of (a) SiGeSn layer, (b) Ge/SiGeSn SL.

As shown in Fig. 4 (a), the Sn and Si content of up to 10% and 42% in the SiGeSn bulk material is confirmed by SIMS, and a clear and uniform SL structure can be seen from Fig. 4(b).

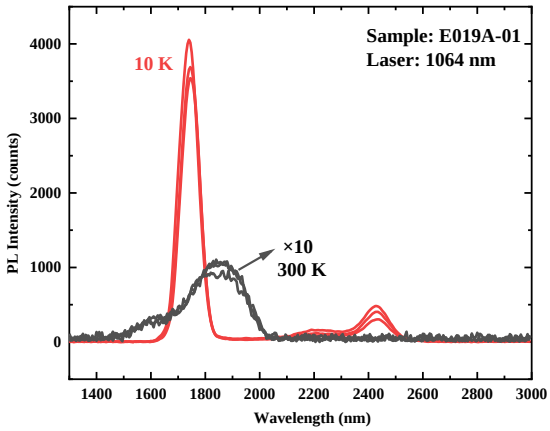

Figure 5. PL results of Ge/SiGeSn SL.

Fig. 5 shows the PL result of Ge/SiGeSn SL. Clear peaks around 1850 nm at 300 K can be observed, and shift to around 1750 nm at 10 K.