Low Temperature Plasma Enhanced Growth of $Si_{1-x}Sn_x$ by Chemical Vapor Deposition

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Thin films of Silicon-tin alloys ($Si_{1-x}Sn_x$) were grown on Si (001) substrate using low temperature plasma-enhanced chemical vapor deposition. These alloys have potential in the application of optoelectronic devices however their growth conditions have not been studied as thoroughly as similar GeSn materials [1]. Precursors like silane have a high breakdown temperature compared to the CMOS process and the solid solubility of Sn in Si is very low and is further complicated by segregation at higher temperatures. Therefore, the growth mechanism of $Si_{1-x}Sn_x$ needs to be better understood [2]. The thin film growth of $Si_{1-x}Sn_x$ in this work was accomplished by adjusting plasma intensity and controlling the precursor flow fractions. The film thickness was measured by Spectroscopic Ellipsometry, and the Sn incorporation and crystallinity were estimated using X-ray Diffraction measurements. In particular, an increase of Sn composition in the $Si_{1-x}Sn_x$ epilayers was concluded by observing the migration of the (004) peak towards the lower angles on the X-ray diffraction 2θ/ω scans, Figure 1, which corresponded to an overall improvement of Sn incorporation of more than 10% relative to the previous work. Moreover, a significant enhancement in material quality was concluded by comparing the line widths (FWHM) of the SiSn peak to those reported previously [3].

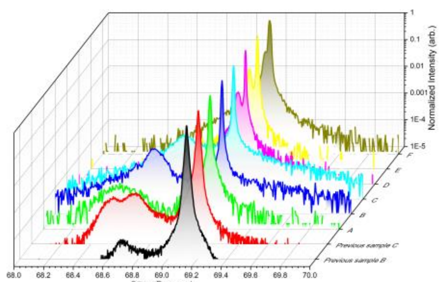

Figure 1: Normalized XRD 2θ/ω scans along the (004) plane. Previous growths are compared with recent growths.

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