

# **Composition Dependence Structural and Optical Properties of Silicon Germanium (Si<sub>x</sub>Ge<sub>1-x</sub>) Thin Films**

## **ABSTRACT**

This study investigates the structural and optical characteristics of Silicon Germanium (SiGe) thin films with varying compositions and annealing temperatures for potential use in electronic and optoelectronic devices. Si<sub>0.8</sub>Ge<sub>0.2</sub> and Si<sub>0.9</sub>Ge<sub>0.1</sub> films were deposited onto a high-temperature quartz substrate and annealed at 600 °C, 700 °C, and 800 °C before being evaluated using an X-Ray Diffractometer (XRD), Atomic Force Microscopy (AFM), and a UV-Vis Spectrometer for structural and optical properties. The results show that increasing the annealing temperature results in an increase in crystalline size for both compositions. The transmittance for Si<sub>0.8</sub>Ge<sub>0.2</sub> decreases slightly with increasing temperature, while Si<sub>0.9</sub>Ge<sub>0.1</sub> remains constant. The optical band gap for Si<sub>0.9</sub>Ge<sub>0.1</sub> thin film is 5.43 eV at 800 °C, while Si<sub>0.8</sub>Ge<sub>0.2</sub> thin film is 5.6 eV at the same annealing temperature. XRD data and surface analysis reveal significant differences between the band edges of SiGe nano-structure materials and bulk crystals. However, the possibility of a SiGe nano-crystal large band gap requires further investigation based on our study and related research works.