Enhancement of SiGe Relaxation for Fabrication of SGOI Substrates Using Condensation

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Strained Si on insulator substrates have become more desirable especially for high performance IC application due to the combined effect of enhanced mobility in the strained channel, and increased speed/reduced power consumption of SOI. To achieve higher level of strain in the channel, SiGe layer needs to be fully relaxed and with high Ge content. Furthermore, to reduce short channel effects and junction leakage, the thickness of the SiGe layer must be thin to satisfy fully depleted devices. To meet these requirements, condensation of thick SiGe on SOI was pursued resulting in balancing Ge concentration, thickness, and relaxation. To achieve a higher level of relaxation and high Ge content, we focused on using vacancy injection techniques. The paper will describe the different ways of injecting vacancies to assist the Ge diffusion, avoid pile-up and improve relaxation of the enriched SiGe film. In addition, these techniques allow reducing the oxidation temperature, which can be a limiting factor for obtaining high Ge concentration in the SiGe film. We will present a high level of relaxation and Ge concentration of thin SiGe films directly on buried oxide with low defect density using the improved Ge condensation technique.

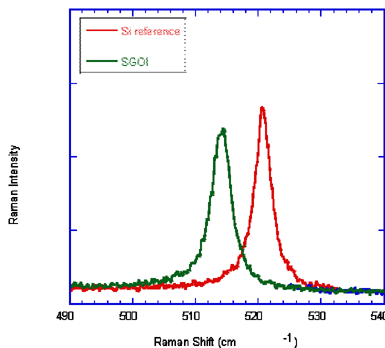

Figure 1. Shows the UV-Raman spectra compared to an unstrained Si reference.

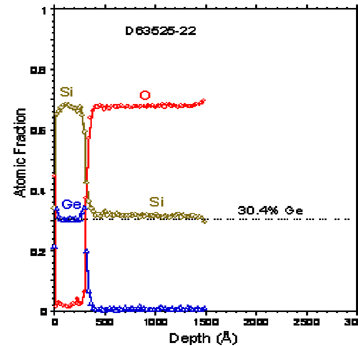

Figure 2. Shows Auger depth profile. This demonstrates capability to achieve 30% Ge.

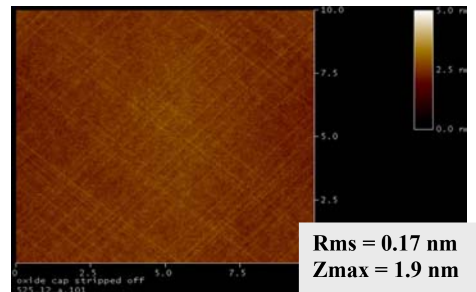

Figure 3. Shows low surface roughness.

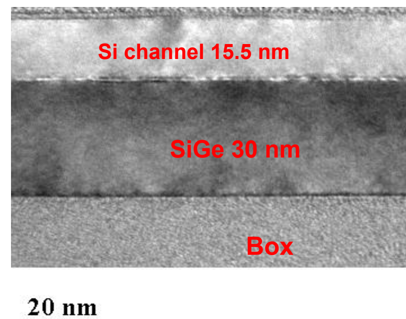

Figure 2. Shows a TEM cross-section of the final SGOI structure.