

Thermo-Electronic, Structural and Morphological Studies of Silicon Doped GaAs Growth by MBE

Alexander Villada^{C, S}

Cinvestav, Unidad Queretaro, Queretaro, México

Maximo Lopez-Lopez

Cinvestav, Unidad Mexico DF, México D.F., México

Sergio Jimenez-Sandoval

Cinvestav, Unidad Queretaro, Queretaro, México

Diego German Espinosa Arbelaez and Mario E. Rodriguez

CFATA-UNAM, Campus Queretaro, Queretaro, México

This work presents a detailed study of the thermo-electronic and structural properties of silicon doped GaAs. The study was made on a set of eight samples grown by Molecular Beam Epitaxy. The temperature of the silicon effusion cell was varied from 1120 to 1330 °C in order to obtain GaAs layers with different silicon concentrations. Parameters such as: substrate temperature, gallium effusion cell temperature, and growing time remained constant. The final Si-doping level was obtained by Hall measurements at room temperature. It is evident that electrical deactivation occurs for higher temperatures than 1240 °C; this phenomenon can be associated with an auto-compensation process. The signal of Photo Carrier Radiometry (PCR) was related to the carrier concentration measured by the Hall effect. Additionally, PCR images were obtained for the whole surface for each sample in order to establish the uniformity of the carrier incorporation into the sample. On the other hand, the structural properties were studied by X-ray rocking curves. We present, for the first time, how the preferential incorporation of the silicon into the GaAs can be observed in the X-ray pattern, comparing the peaks corresponding to the (400) and (200) directions. By making a correlation between Hall measurements, PCR intensity, and the X-ray pattern, is possible to determinate that auto-compensation is not the only mechanism to explain the electrical deactivation.