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Defect and Strain Profiles caused by Ion Implantation in GaN

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Gallium Nitride (GaN) is a wide bandgap semiconductor, with a broad range of optical and electric applications. One field of particular interest is the area of power electronics, as group III nitrides are handled as an energy-efficient alternative for the currently used silicon power devices. Indeed, GaN technology has matured during the last two decades promising huge energy savings if widely adopted in electronic and optoelectronic devices.

Nevertheless, several materials and processing challenges are still limiting the wide introduction of GaN devices in the power electronics market. One example is the usage of ion implantation for doping the materials and enhancing some of its properties. However, during this process, a lot of damage is created in the material, hampering their efficiency. This damage includes the creation of defects and strain in the samples, whose formation mechanisms are not still completely understood, making their study an important subject.

In this work, I will study the defect and strain profiles in GaN samples, implanted with Eu and Si, using Rutherford Backscattering Spectrometry/Channeling and X-Ray Diffraction. Analytical models and Monte Carlo simulations will be used to try to fit the obtained experimental data, and develop a model based on these techniques that provides a more accurate description of the data, and so, of the physical processes behind them. In the end, I expect to provide a better understanding for the mechanisms of damage formation, as well as alternatives that may help reduce the strain and the defects.

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