Investigation of metastable deep defects in semiconductors using generation recombination noise. H.P. Gislason and D. Seghier, Science Institute, University of Iceland. haflidi@hi.is

Extensive work has been devoted to metastable defects in semiconductors. The dominant reasons for the intensive research are the effects of these defects on the electrical and optical properties of the material as well as on device performance. Wide-bandgap materials such as GaN and its alloys have an excellent potential for applications in high-temperature/high-power/high-frequency electronics. However, only a few investigations of localized deep centers in GaN and its alloys have been reported so far. Also, it is known that metastable defects are more common in wide-bandgap materials and have crucial effects on the properties of the material.

Noise spectroscopy is an effective tool for characterizing the quality of semiconductor bulk and surface and a figure of merit for device quality as a whole. Further, measurements of the generation-recombination noise characteristics of semiconductor materials are a useful technique when it comes to studying deep defects which exhibit a thermally activated capture. The usual characterization techniques are not suitable for a complete investigation of such defects.

We present the technique of noise spectroscopy and illustrate it with some applications. They include photocapacitance and noise measurements on a deep DX-like defect which gives rise to persistent photoconductivity in Mg-doped p-type GaN films. We also apply deep level transient spectrospy (DLTS), photoconductivity and noise spectroscopy to characterize n-type bulk GaAs and an EL2-related metastable defect. We discuss the intercation between silicon doping and El2. In the light of these results the nature and origin of the responsible centers are discussed.