

A Spectroscopic Study by Photoluminescence of Erbium in Gallium Nitride

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Abstract : The III-N nitride semiconductors appear to be excellent host materials, in particular, GaN epilayers doped with Erbium ions have shown a highly reduced thermal quenching of the Er luminescence intensity from cryogenic to elevated temperatures. The remarkable stability may be due to the large energy band gap of the material. Two methods are used for doping the Gallium nitride films with Erbium ions; ion implantation in the wafers obtained by (CVDOM) and in-situ incorporation during epitaxial growth of the layers by (MBE). Photoluminescence (PL) spectroscopy has been the main optical technique used to characterize the emission of Er-doped III-N semiconductor materials. This technique involves optical excitation of Er^{3+} ions and measurement of the spectrum of the light emission as a function of energy (wavelength). Excitation at above band gap energy leads to the creation of Electron-Hole pairs. Some of this pairs may transfer their energy to the Er^{3+} ions, exciting the 4f-electrons and resulting in optical emission. This corresponds to an indirect excitation of the Er^{3+} ions by electron-hole pairs. The direct excitation by the optical pumping of the radiation can be obtained.

Keywords : photoluminescence, Erbium, GaN, semiconductor materials

Conference Title : ICQPO 2016 : International Conference on Quantum Physics and Optics

Conference Location : Istanbul, Türkiye

Conference Dates : July 21-22, 2016