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Blue Emission from Tm doped AlN Grown by Molecular Beam Epitaxy

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Visible emission from lanthanide ions incorporated in nitride materials have been shown recently, to be very important for multi-color applications. In this article we report the observation of photoluminescence and cathodoluminescence from AlN thin films grown on sapphire (0001) by molecular beam epitaxy and implanted with Tm³⁺ ions. The strongest rare earth (RE) CL and PL were observed from samples annealed at 1050 °C for 20 min in NH₃ ambient. The sharp characteristic emission lines corresponding to Tm³⁺ 4f-4f shell transitions are resolved in spectral range from 250 to 1000 nm. The CL spectra were recorded over 1-10 keV electron, when the PL was recorded using 325 nm excitation wavelength (below bandgap excitation) in the temperature range of 6 -330 K. Dominant CL emission color is blue due to ¹G₄→³H₆ transition at 300 K, whereas in PL emission line at ~800 nm (¹G₄→³H₆) dominates. Furthermore, time resolved spectra, CL and PL kinetics were recorded for energy migration processes study. We have also discussed possible excitation mechanisms of Tm ions in AlN.

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