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A modification of Eu incorporation sites by the dissociation of hydrogen defect complexes in Mg co-doped Eu doped gallium nitride BRANDON MITCHELL, Lehigh University, JONATHAN POPLAWSKY, Oakridge National Lab, VOLKMAR DIEROLF, Lehigh University — Europium doped gallium nitride (Eu:GaN) is a promising candidate as a material for red LEDs that can monolithically be integrated with existing nitride based lighting technology. Photoluminescence (PL) and cathodoluminescence (CL) studies have revealed, however, that the majority incorporation environment (site) for the Eu is not efficiently excited by electron hole pairs. To improve this efficiency, Mg was co-doped into Eu:GaN during metal organic chemical vapor deposition and multiple new incorporation environments were discovered. These new sites show a high efficiency at room temperature and have been attributed to the coupling of a Mg-H complex to the majority Eu site. However, we also observe that sustained electron beam irradiation produced a semi-permanent change in the CL spectra of the sample. It was demonstrated that this change occurs in two distinct steps which exhibit a pronounced temperature dependence. Our observations point toward a dynamic system in which the Mg-H bond is broken and the hydrogen moves within the epi-layer. Details of this behavior will be discussed.

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