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# The role of extended defects in Nitride Semiconductors on the performance of optoelectronic devices

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— The question is why nitride semiconductors, which are plagued by high concentration of extended defects, produce efficient minority carrier optoelectronic devices. The equilibrium phase of these materials is the wurtzite and the metastable phase is the zinc blende. However, since the enthalpy of formation of these two structures differ by only a few meV, the conversion from one to the other can occur easily by the creation of stacking faults on the close packed planes. Thus, stacking faults are one of the most abundant defects in these materials even when they are grown homoepitaxially. Since the basal plane stacking fault is the equivalent of a monolayer of a cubic domain and since the energy band gaps of the wurtzite and their cubic counterparts differ by about 0. 2 eV, one expects that stacking faults introduce band structure potential fluctuations. Such fluctuations are beneficial to the performance of lasers and LEDs since they lead to exciton localization and efficient radiative recombination. Other types of abundant defects in heteroepitaxially grown materials are threading dislocations. The insensitivity of the performance of LEDs and lasers to such defects is due to the strong ionicity of these materials as well as to the deep band structure potential fluctuations in the InGaN and AlGaN alloys. Due to the strong ionicity the surface states at free surfaces and dangling bonds in edge dislocations have moved towards the band edges and act as traps rather non-radiative recombination centers.

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