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Stress-assisted migration of vacancies in GaN HEMTs[1] KEITH WARNICK, YEVGENIY PUZYREV, SOKRATES PANTELIDES, Vanderbilt University — GaN is widely used in the fabrication of High Electron Mobility Transistors (HEMTs), but limited understanding of degradation mechanisms still hampers applications. At moderate bias, an inverse piezoelectric effect in GaN induces stress that often leads to cracking. A possible role of stress-induced defects and defect migration remains elusive. Here we examine the possibility that lattice stress may favor vacancy formation and migration by strain relaxation as a possible precursor to crack formation and device failure. We report results of first-principles density functional calculations of the dependence of both Ga and N vacancy formation and migration energies under strain and electric field and assess the impact of these factors on degradation in GaN HEMTs. Migration barriers are calculated by a Nudged Elastic Band (NEB) method. The results will be assessed against experimental data.

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