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Point and Extended Defects in GaN-based Materials

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In this presentation, the origin and evolution of threading dislocations in GaN heteroepitaxy are reviewed. For heteroepitaxial of GaN on most substrates (e.g., sapphire, MgAl_2O_4 , SiC, ...) high temperature GaN grows in a Volmer-Weber mode. Threading dislocations result from island coalescence. The evolution of threading dislocations has been extensively modeled. Tensile stress generation via threading dislocation inclination is a major ongoing issue in GaN growth. We review older and more recent work on the impact of threading dislocations in GaN materials properties and device performance. Finally, we review recent work from our group on stress relaxation in nonpolar and semipolar GaN. We demonstrate the first GaN-based laser diodes grown on intentionally stress-relaxed buffer layers and we demonstrate control of relaxation in semipolar laser diodes by selective area growth.