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Impact of point defects on III-nitride tunnel devices.[1] DARSHANA WICKRAMARATNE, Materials Department, UC Santa Barbara, JOHN LYONS, Center for Functional Nanomaterials, Brookhaven National Laboratory, CHRIS G. VAN DE WALLE, Materials Department, UC Santa Barbara — Heterostructures using GaN and InGaN are being pursued in designs of tunnel field-effect-transistors (TFETs) to enable low-power switching devices. Point defects and impurities in these heterostructures can adversely affect the performance of these devices through Shockley-Read-Hall (SRH) and Trap-Assisted-Tunneling (TAT) processes. Using first-principles calculations based on a hybrid functional, we calculate the thermodynamic and charge-state switching levels as well as nonradiative recombination rates of point defects and impurities in GaN and InGaN. Gallium vacancies and their complexes, in particular, are found to be potentially detrimental centers. We then investigate how these defects can contribute to SRH and TAT processes in a nitride TFET device.

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