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Structural and electronic properties of BInGaN alloys lattice-matched to GaN[1] LOGAN WILLIAMS, EMMANOUIL KIOUPAKIS, University of Michigan — Blue LEDs based on InGaN alloys find important commercial applications for solid-state lighting and displays (Nobel Prize in Physics, 2014). However, the constraints imposed by currently used materials reduce the efficiency of nitride LEDs at high power and longer wavelengths. In particular, the large lattice mismatch between InN and GaN causes a strong strain on InGaN quantum wells grown epitaxially on GaN, which in turn limits the thickness of high-crystalline-quality quantum wells that can be grown. Narrow quantum wells are linked to high operating carrier densities and thus a significant role of nonradiative Auger carrier recombination during device operation, which suppresses the efficiency. In this work, we investigate the effect of Boron incorporation into InGaN alloys on the structural and electronic properties. Boron is a smaller atom that GaN, and yields BInGaN alloys that are lattice-matched to GaN, while enabling the tuning of the band gap in the visible range. Our results establish the connection between the BInGaN alloy composition and the LED emission wavelength for alloys that are lattice-matched to GaN.

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