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Direct-Indirect Crossover in $Ga_xIn_{1-x}P$ Alloys ANGELO MASCARENHAS, KIRSTIN ALBERI, BRIAN FLUEGEL, National Renewable Energy Laboratory — Advances in metamorphic growth of high quality $Ga_xIn_{1-x}P$ ($x > 0.5$) on GaAs substrates have improved the practicality of using these alloys in visible light emitting diodes and lasers. The wavelength range over which these materials are efficient light emitters is determined by the direct-indirect crossover energy, yet considerable discrepancies still remain in the literature regarding the precise crossover composition, x_C. We revisit this topic and present new experimental results that precisely pinpoint the crossover composition without extrapolation of the direct and indirect bandgap trends. Observation of concurrent yet distinct direct and indirect transitions in the 2 K time integrated and time resolved photoluminescence spectra of disordered $Ga_{0.719}In_{0.281}P$ films places the crossover very near the composition $x_C = 0.71$. This revised value is critical for facilitating realistic engineering of $Ga_xIn_{1-x}P$ alloys for light emitting and photovoltaic applications.

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