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Localized-delocalized transitions in GaAsN KIRSTIN ALBERI, BRIAN FLUEGEL, National Renewable Energy Laboratory, SCOTT CROOKER, National High Magnetic Field Laboratory, Los Alamos, DANIEL BEATON, AARON PTAK, ANGELO MASCARENHAS, National Renewable Energy Laboratory — Dilute nitride semiconductors are promising materials for high efficiency multijunction solar cells and light emitting diodes, yet they exhibit an unusual evolution of their optical and electronic properties as they transition from an impurity-doped semiconductor into an alloy upon the addition of N. For example, a significant change in the photoluminescence spectrum of GaAsN is accompanied by a rapid increase in the broadening parameters of the E_0 and E_1 critical point transitions in electromodulated reflectance spectra as the N concentration is increased from 0.12% N to 0.32% N. We demonstrate that these changes result from the percolation of localized N cluster states bound below the conduction band into fully extended superclusters and the emergence of a mobility edge. Furthermore, photoluminescence studies show that we are able to reverse this localized to delocalized transition through the application of high magnetic fields to 57 tesla. These experimental results provide new insight into the percolation behavior of isoelectronic cluster states in semiconductor alloys.

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