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Defect-related recombination and free-carrier diffusion near an isolated defect in GaAs[1] MAC READ, TIM GFROERER, Davidson College, MARK WANLASS, NREL — When defects are present in semiconductors, localized energy levels appear within the bandgap. These new electronic states accommodate heat-generating recombination – a problematic energy loss mechanism in many semiconductor devices. But at high excitation, the density of electrons and holes is higher, so they encounter each other more frequently. Early encounters augment light-emitting recombination, reducing the average lifetime and diffusion distance so the carriers are less likely to reach defects. In images of the light emitted by GaAs, we observe isolated dark regions (defects) where the darkened area decreases substantially with increasing excitation. When we modeled the behavior with a simulation that allows for lifetime-limited diffusion and defect-related recombination only through mid-bandgap energy levels, we did not obtain good agreement between the experimental and simulated images. We are now testing a more sophisticated model which allows for an arbitrary distribution of defect levels within the bandgap.

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