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Ultrafast dynamics of metallic ErAs nanoparticles embedded in a GaAs matrix[1] STEPHANIE GILBERT CORDER, NORMAN TOLK, Vanderbilt University — Embedded ErAs nanoparticles alter the transport characteristics of the electronic states in the surrounding matrix by introducing localized states into the GaAs bandgap. Utilizing near-infrared pump-probe spectroscopy, we observe two distinct material regimes of carrier relaxation in a time window of less than two picoseconds. The initial transient response is consistent with photo-carriers generated in the GaAs and captured by the ErAs nanoparticles. The capture times are very dependent on photo-carrier density and nanoparticle density; with faster capture times associated with lower densities of both. In addition, we observe the signature of carriers moving from the ErAs interface state in to the GaAs matrix, resulting in larger populations of cool carriers at longer time delays. As of yet, no time-resolved studies have reported carrier transfer back into the GaAs matrix. This transfer of extra carriers due to the presence of the ErAs/GaAs interface state appears to saturate, although further work is needed to conclusively determine the saturation level.

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