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Transient Infrared Studies of Carrier Injection Effects on the Reststrahlen Band of SiC BRYAN SPANN[1], RYAN COMPTON[2], ADAM DUNKELBERGER[3], JAMES LONG, Naval Research Laboratory, PAUL KLEIN, Sotera Defense Solutions Inc., JOSH CALDWELL, JEFF OWRUTSKY, Naval Research Laboratory — Sub-diffraction light confinement has led to advances in imaging, metamaterials, and plasmonics among other fields. A phenomenon that can provide sub-diffraction light is the surface phonon polariton (SPhP). SPhPs couple infrared photons with optical phonons. Because SPhPs are coupled directly to phonons, lifetimes can be longer than that of surface plasmon polaritons (SPPs) whose lifetimes are dominated by electron scattering. SiC is one material that exhibits SPhPs. SiC SPhPs are activated by photons with energies near the Reststrahlen band. In this study we investigate aspects of carrier dynamics by photo-injecting free carriers into the SiC conduction band using a pulsed 355 nm pump laser and probe the resulting dynamics near the Reststrahlen band using a tunable CO2 laser. Variable pump fluences provided free carrier densities of $1x10^{17}$ to $1x10^{19}$. Probing the excited state dynamics near the Reststrahlen band revealed complex transient behavior resulting in positive and negative changes in transient reflectance depending on the photo-injection level and the probe energy. Numerical simulations were carried out to mimic the initial photo-injection level provided by the transient experiment and resulted in qualitative agreement with the experiment.

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