OPTICALLY PUMPED RESTSTRAHLEN BAND TUNING OF WIDE BANDGAP SEMICONDUCTORS

ELIZABETH S RYLAND[a], VANESSA M BRESLIN[b], DANIEL C RATCHFORD, JEFF OWRUTSKY, ADAM DUNKELBERGER, *Chemistry Division, Code 6111, U.S. Naval Research Laboratory, Washington, DC, USA*.

Photoinjection studies of two wide bandgap semiconductors, 4H-SiC and GaN, are conducted with fs infrared reflectivity measurements in order to characterize how the relative penetration depths of UV-pump/IR-probe light affects the modulation of the IR reflectivity spectrum. The infrared spectrum of these materials is dominated by the high reflectivity reststrahlen band region that occurs between the longitudinal optical and transverse optical phonons. The injection of free carriers shifts this metal-like region to higher frequencies via coupling of the longitudinal optical phonon to the free carrier plasma (LOPC effect). The result of this LOPC active tuning is strongly perturbed by the charge carrier spatial distribution, and is thus highly sensitive to the means of carrier generation. We probe the effects of charge carrier spatial distribution on the photomodulated reflectivity of two promising wide bandgap semiconductors, indirect bandgap 4H-SiC and direct bandgap GaN, by comparing the transient reflectivity following photoexcitation with light of short and long penetration depths relative to the IR probe depth. This work shows sensitivity of bulk electronic properties to the charge carrier distribution that is critical to understanding the contributions of these materials to complex nanophotonic devices.

---

[a]NRC RAP Postdoctoral Associate

[b]NRC RAP Postdoctoral Associate