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Energy loss behavior of photo-generated multi-component carriers in GaN[1] KYUNG-SOO YI[2], Pusan Natl Univ, HYE JUNG KIM, Univ of Ulsan, DO-KYUN KIM, Pusan Natl Univ — Temporal behavior and many-body effect on the energy losses of photo-generated electron-hole plasma in GaN are examined in terms of various carrier-phonon couplings. We report a comprehensive cooling behavior as a function of effective carrier temperature over the temperature range of 10 -1500 K for carrier-phonon couplings via polar and nonpolar optical phonons and piezoelectric and acoustic deformation-potentials. The many-body effect on the multi-component carrier polarizations and phonon spectral function and effect of energy reabsorption via hot phonons are included by employing temperature-dependent dynamic responses in the rpa. We show that, as the carrier temperature decreases, the energy losses via carrier-optical phonon couplings diminish rapidly and the carrier energy relaxation is dominated through the acoustic phonon scattering at low carrier energy. From the energy loss rates, energy cooling curves are obtained as a function of time, and our result shows an initial gentle energy relaxation followed by fast relaxation. Spectral analysis of the dielectric response functions and energy loss rates are also performed and their dynamic and nonlocal behavior will be discussed.

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