

and

$$2\omega \frac{\text{Im}(r_p^G)}{\text{Im}(k_{z0})} = |t_p^G|^2 \frac{\text{Re}(\sigma)}{\epsilon_0} \quad (32)$$

we recover Eq. (1). Above derivation focuses on p -polarized, evanescent ($q > \omega/c$) modes, which contribute the most to the radiation transfer in the near field. An alternative way to derive the near-field transfer in the case of graphene is to calculate, using reciprocity, the radiative power exchange when medium 2 is the emitter. We then estimate the absorbed power in the graphene sheet as the product of its conductivity σ and the surface current density that in-plane, q -component of the electric field at $z = 0$ would induce. This approach confirms Eq. (1).

Appendix C

Optimizing the heat transfer ratio as a function of chemical potential μ and relaxation time τ (Fig. 8) leads to several conclusions. First, flux ratios calculated using $\mu = 0.25eV$ and $\tau = 10^{-13}s$ (Fig. 7 and Table 2) for $T_1 = 600(1200)K$ were close to their respective optimal values. Second, slow variation of the optimal flux ratio as a function of chemical potential is consistent with the broadband nature of spectral transfer in the case of graphene versus the pure plasmonic emitter (Fig. 7(b)). Finally, leveling of the flux ratio for high enough values of relaxation time, with a reduction in impurity or phonon scattering, indicates a transition to loss processes dominated by interband transitions (13).

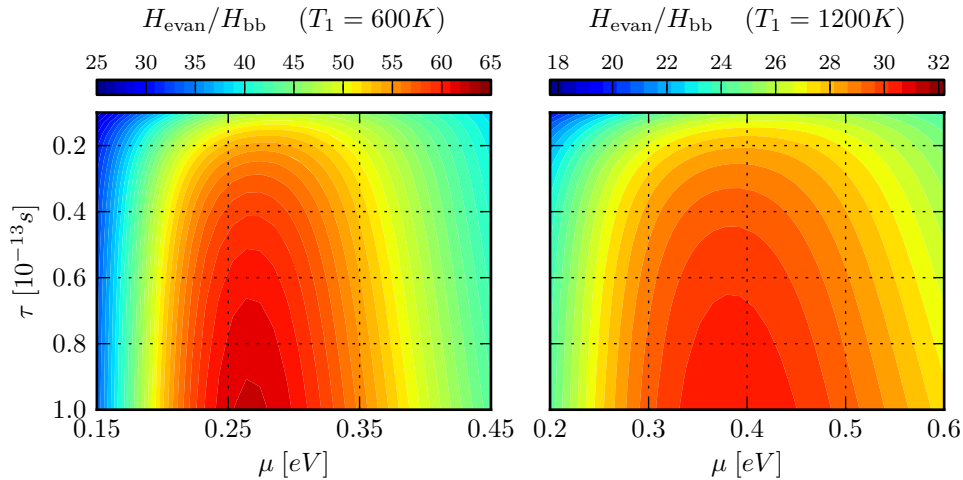


Fig. 8. Optimization of the flux ratio $H_{\text{evan}}/H_{\text{bb}}$ for graphene-PV near-field TPV system, where $\omega_g = 0.17eV$, $D = 10nm$.