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Mode coupling effect in infrared spectra of $Tl_2Ba_2Ca_{n-1}Cu_nO_x$ (n=1, 2, 3) N.L. WANG, Y.C. MA, Institute of Physics, Chinese Academy of Sciences, Beijing 100080 — We performed in-plane optical reflectance measurements on $Tl_2Ba_2Ca_{n-1}Cu_nO_x$ with n=1, 2, 3. The single crystals were successfully grown by flux method with maximum T_c=90 K, 109 K, and 119 K for n=1, 2, 3, respectively. For all three phases near optimal doping, the reflectance roughly has a linear-frequency dependence in the normal state, but displays a pronounced knee structure followed by a dip-like feature at higher frequency below T_c. Such characteristic features were commonly ascribed to the coupling of electrons with a bosonic mode. Very remarkably, we found that the energy levels of those features scale with T_c for the three phases. The results suggest against a phonon origin for the bosonic mode. We also investigated the spectral evolution with doping for Tl-2201 crystals in the overdoped side. We found that the mode coupling effect weakens with doping and disappears in the heavily overdoped sample. Meanwhile, the optical scattering rate evolves from a linear- ω dependence to a shape with upward curvature in the normal state. Both the temperature and frequency dependence of the scattering rate can be described by a power law relation. Compared with ARPES results, we suggest that the overall decrease of the scattering rate may mainly originate from the increase of the quasiparticle life time near the (π,0) region in the Fermi surface.

Nan Lin Wang
Institute of Physics, Chinese Academy of Sciences, Beijing 100080

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