Supplementary Material

Role of the interlayer interactions in ultrafast terahertz thermal dynamics of bilayer graphene

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Graphene samples fabrication

The graphene in the present study is synthesized by a chemical vapor deposition (CVD) method and then transferred to SiO_2. For an optical study, a poly methyl methacrylate PMMA layer is spin-coated on the as-grown graphene on Cu-foil. Then, the Cu-layer is etched out using a 0.1M ammonium per sulphate $(NH_4)_2S_2O_8$ solution. After rinsing with de-ionized water several times, graphene was transferred onto the fused SiO_2 substrate. Finally, the PMMA layer is dissolved in acetone three times. To remove any possible PMMA residual, the graphene sample is annealed in a vacuum at 350 °C for 1.5 h.

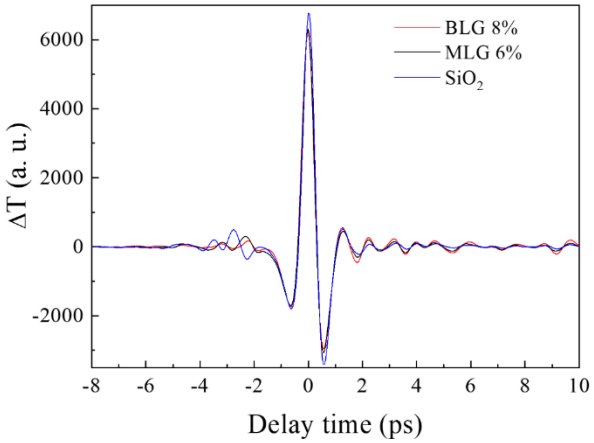

Figure S1. The static terahertz time domain spectroscopy of the substrate, BLG and MLG.

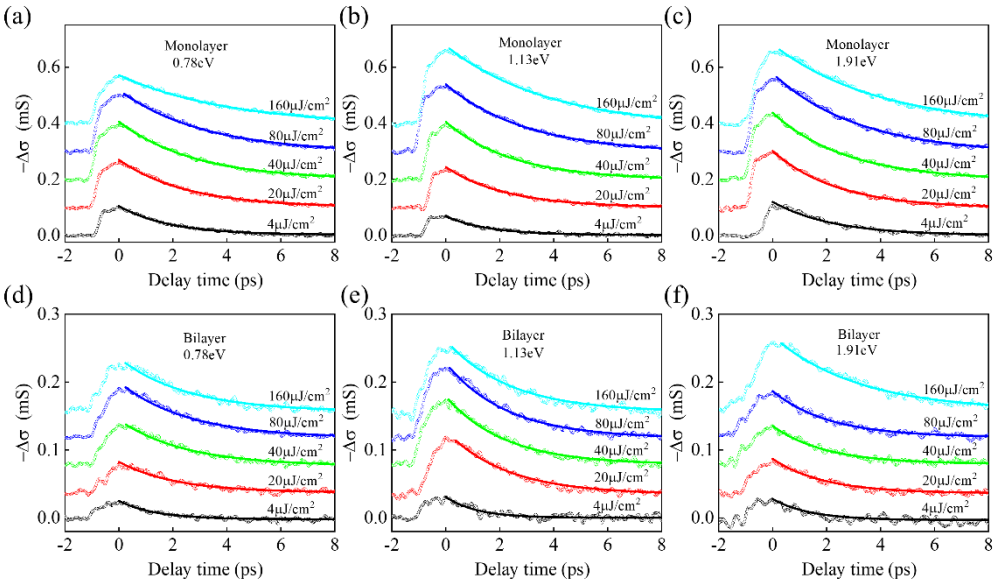

Figure S2. The time-resolved signals Δσ of BLG and MLG films dependent on the different pump fluence. (a) - (c) The dependence of photoinduced THz conductivity of monolayer graphene as a function of the delay time at 0.78 eV, 1.13 eV and 1.91 eV, respectively; (d) - (f) The photoinduced THz conductivity of bilayer graphene as a function of the delay time at 0.78 eV, 1.13 eV and 1.91 eV, respectively.

The measurement is based on the principle that ΔE is proportional to $\Delta\sigma = \frac{1+n}{Z_0}\left(\frac{1}{1+\Delta T/T_0} - 1\right)$ where $n = 1.95$ is the refractive index of the fused silica substrate, and $Z_0 = 377$ is the free space impedance. The time-resolved signals $\Delta\sigma$ of monolayer and bilayer graphene films dependent on the different pump fluence under pump photon energy of 0.78 eV, 1.13 eV, and 1.91 eV are shown in Figure S2, respectively.