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Surprising Effects of Substrate on Thermal Transport in Supported Graphene ZHUN-YONG ONG, Physics Department, University of Illinois at Urbana-Champaign, ERIC POP, ECE Department, University of Illinois at Urbana-Champaign — We study thermal transport in graphene "supported" on SiO2 using molecular dynamics (MD) simulations. We find that coupling to the substrate leads to an order of magnitude decrease in the apparent thermal conductivity (TC), explaining recent experiments [1]. This reduction is due to the substrate damping of flexural acoustic (ZA) phonons, which implies that the high TC of isolated graphene is due to the large mean free path of long-wavelength ZA modes [2]. However, we find that by increasing the strength of the interfacial interaction, the apparent TC is enhanced by up to a factor of four. Using a continuum model [3], we relate the apparent TC enhancement to the ZA modes coupling with the substrate Rayleigh waves. In the weak coupling limit, the ZA modes have a quadratic dispersion and small group velocities at long wavelengths; in the strong coupling limit, the hybridized interfacial modes have a linear dispersion and larger group velocities. This finding suggests that the TC of supported graphene may be tunable through interfacial interaction.

[1] J. H. Seol et al., Science 328, 213 (2010)
[2] L. Lindsay et al., PRB 82, 115427 (2010).
[3] B. N. J. Persson et al., EuroPhys. Lett. 91, 56001 (2010)

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