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Intrinsic and Extrinsic performance limits of graphene device on SiO₂¹ JIANHAO CHEN, CHAUN JANG, SHUDONG XIAO, MASA ISHIGAMI, MICHAEL FUHRER, Mater. Res. Sci. and Eng. Ctr., Ctr. for Nanophys. and Adv. Mater., and Dept. of Phys., Univ. of MD, College Park, MD 20742 — We have measured the temperature-dependent resistivity of clean graphene devices on SiO₂ from 16K to 485K in ultra high vacuum[1]. Longitudinal acoustic phonons, intrinsic to graphene, give rise to the measured resistivity linearly dependent on temperature from 16 to ~200K. Above 200 K, a sharp upturn in resistivity is observed due to remote interfacial phonon (RIP) scattering by the polar optical phonons of the SiO₂ substrate. Combining the contributions from intrinsic and extrinsic phonons, we are able to explain the complete temperature and carrier density dependence of the graphene resistivity on SiO₂. For a technologically relevant carrier density of $n = 10^{12} \text{ cm}^{-2}$ at room temperature, the intrinsic phonon scattering will only limit the mobility to $\sim 2 \times 10^5 \text{ cm}^2/\text{Vs}$, while the extrinsic RIP scattering from SiO₂ will limit the mobility to $\sim 4 \times 10^4 \text{ cm}^2/\text{Vs}$. [1] J. H. Chen, et al., <http://arxiv.org/abs/0711.3646>

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Jianhao Chen
Materials Research Science and Engineering Center, Dept of Physics,
University of Maryland, College Park, MD 20742 USA

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