

Infrared study of carrier scattering in graphene field effect device $2h0'$

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Joo Youn Kim (University of Seoul, Seoul 130-743, Republic of Korea)
Kwangnam Yu (University of Seoul, Seoul 130-743, Republic of Korea)
Chul Lee (University of Seoul, Seoul 130-743, Republic of Korea)
Sukang Bae (Sungkyunkwan University, Suwon 440-746, Republic of Korea)
Sang Jin Kim (Sungkyunkwan University, Suwon 440-746, Republic of Korea)
Keun Soo Kim (Sejong University, Graphene Research Institute, Seoul 143-747, Republic of Korea)
Byung Hee Hong (Seoul National University, Seoul 151-742, Republic of Korea)
E. J. Choi (University of Seoul, Seoul 130-743, Republic of Korea)

We determined carrier scattering rate (Γ) of grapheme from Far-IR transmission measurement on CVD-graphene/SiO₂/p-Si field effect device. As carrier density (n) is varied by applying the gate voltage exhibits distinct n -dependent change which is represented by two polynomial scatterings as $\Gamma(n) = A/n + B \cdot \sqrt{n}$. The A/n -scattering and $B \cdot \sqrt{n}$ -scattering plays dominant role in the low- n and high- n regime respectively, whereas they have equal strength at $n = n_c = 2 \times 10^{12} \text{ cm}^{-2}$. We calculated dc-conductivity ($\sigma_0(n)$) from $\Gamma(n)$ finding that $\sigma_0(n)$ exhibits the linear-to-sublinear crossover at $n = n_c$ due to that $\Gamma(n)$ switches from A/n to $B \cdot \sqrt{n}$ at this density. It accounts for the sub-linear behavior of I-V curve, long-standing puzzle in graphene physics. We discuss possible origin of the A/n and $B \cdot \sqrt{n}$ scattering in terms of the charged-impurity, phonon, and short-range adatom scattering.

Primary author: CHOI, E.J. (Univ. of Seoul, Korea)

Presenter: CHOI, E.J. (Univ. of Seoul, Korea)

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