Dynamic Local Strain in Graphene Generated by Surface Acoustic Waves

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Abstract

We experimentally demonstrate that the Raman active optical phonon modes of single-layer graphene can be modulated by the dynamic local strain created by surface acoustic waves (SAWs). In particular, the dynamic strain field of the SAW is shown to induce a Raman scattering intensity variation as large as 15 % and a phonon frequency shift of up to 10 cm^{-1} for the G band, for instance, for an effective hydrostatic strain of 0.24 % generated in single-layer graphene atop a $LiNbO_3$ piezoelectric substrate with a SAW resonator operating at a frequency of ~400 MHz [1]. Thus, we demonstrate that SAWs are powerful tools for modulating the optical and vibrational properties of supported graphene by means of the high-frequency localized deformations tailored by the acoustic transducers, which can also be extended to other 2D systems.

References

[1] Rajveer Fandan et al., "Dynamic local strain in graphene generated by surface acoustic waves". Nano Letters 20.1 (2019): 402-409.

Figures

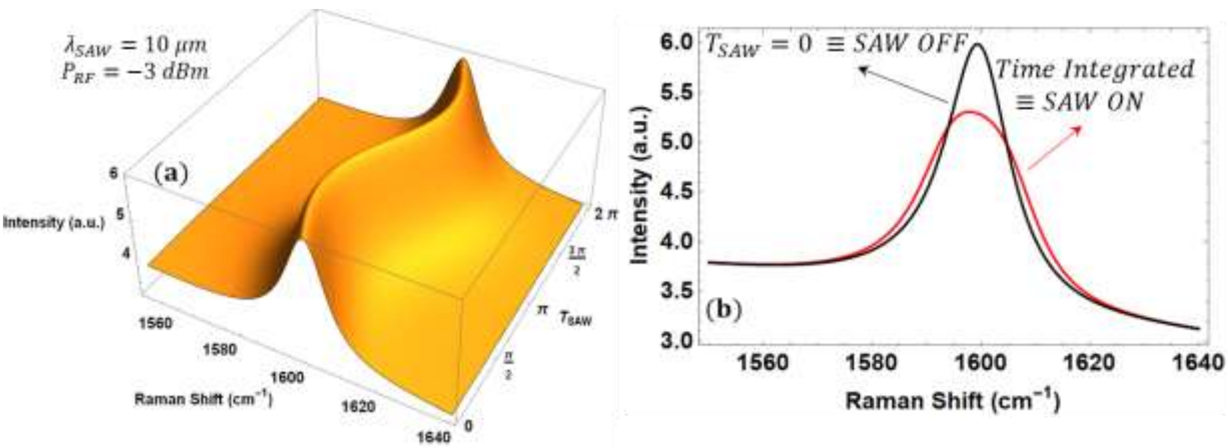

Figure 1: (a) Simulated time evolution of graphene G peak under SAW excitation. (b) Measured G peak intensity variation and broadening under SAW excitation.