

Asymmetric graphene nanoribbon arrays for tunable Fano resonance in the mid-infrared region

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I report the observation and tuning of Fano resonances in the mid-infrared spectrum using asymmetric graphene nanoribbons (A-GNRs) structure under transverse magnetic (TM) polarized light (Fig. 1). The asymmetry introduces two distinct plasmonic modes, which interfere to form a sharp Fano resonance (Fig. 2). The resonance profile, can be dynamically controlled by varying nanoribbon widths and graphene doping levels. My simulations confirm that graphene's unique tunable conductivity [1] and strong field confinement [2] allow precise control of resonance properties. The use of structural asymmetry enhances the field localization and spectral sharpness, providing design flexibility for mid-infrared optoelectronic devices such as tunable filters, modulators, and sensors [3,4].

References

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- [3] A. Vakil, N. Engheta, Science, 332 (2011) 1291.
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Figures

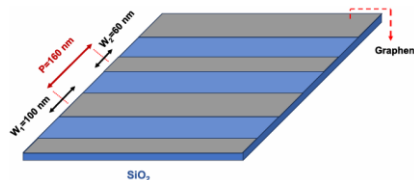


Figure 1: Schematic of the A-GNRs structure consists of 60 nm and 100 nm width graphene ribbons (shown by grey colour) which are arranged on top of a SiO₂ layer (shown by blue colour) with the periodicity of 160 nm.

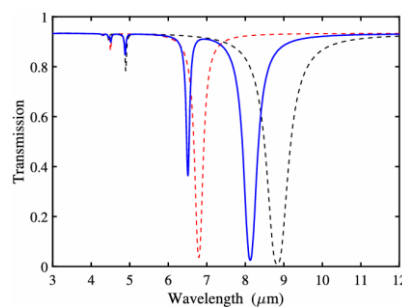


Figure 2: Transmission spectrum for the A-GNRs structure with dimensions presented in Fig. 1 (blue solid line) along with transmission spectrum for GNRs structure with $W_1 = W_2 = 60$ nm (Black dashed line) and $W_1 = W_2 = 100$ nm (red dashed line) width of graphene layer. Fermi energy is set to be $E_f = 0.75$ eV for all the structures.