A Dielectric-Cavity-Based Graphene Emitter with Improved Emissivity in Near-Infrared

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Abstract: The excellent properties of graphene, such as high current saturation and temperature stability, ensures that it is a suitable material for use in emission. However, according to Kirchhoff's laws, the emissivity of graphene is equal to its absorptivity, i.e. 2.3% from visible to near-infrared. In this study, a graphene emitter is presented that is based on a dielectric cavity, and the emissivity of the graphene has been improved from 0.023 to 0.3. The electron temperature of graphene has been estimated at a value of 780 ± 10 K, as deduced by a comparison of the emission spectra of the graphene emitter with a blackbody reference spectrum. The lattice temperature of graphene is approximately 710 K, derived from simulation calculations performed using the COMSOL Multiphysics software. The emission peak could be tuned by changing the thickness of the thickness of alumina layer. The proposed emitter works well with the bulk MOSFET process and has great potential for future imaging and communication in the near-infrared.

References

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Figures

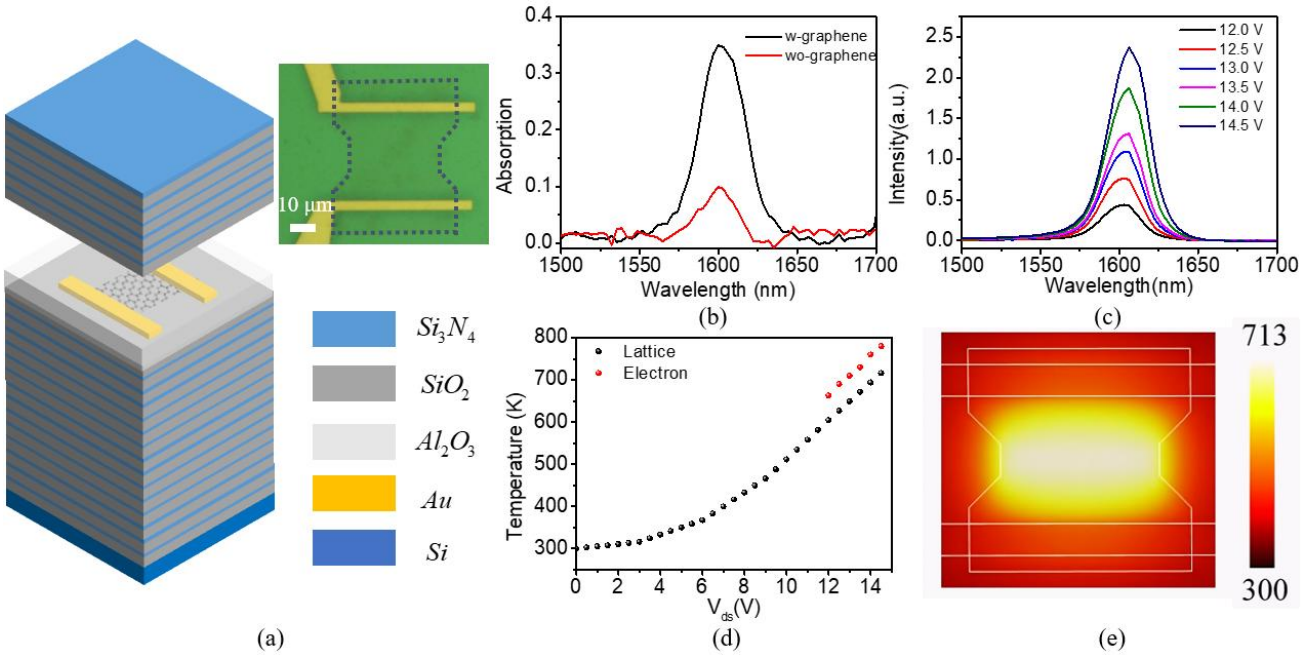

Figure 1: (a) Schematic of the graphene emitter. (b) The measured absorption spectra. (c) The emission spectra, (d) temperature of electron and lattice under different voltages. (e) The temperature distribution of the graphene at 14.5 V.