GRAPHENE HYBRID METASURFACES FOR MID-IR SENSORS

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Mid-infrared (MIR) technologies are critical for a range of applications from molecular sensing to thermal imaging. However, a significant challenge remains in combining the requirements of high responsivity, room temperature operation, fast response, micro-scaling, low power consumption, low costs and utilising abundant and non-toxic materials. Here, we explore an innovative approach of integrated graphene-metal metasurface microdevices [1].

We will show that the unique optoelectronic properties of graphene (ultra-fast, broadband, tunability, flexibility) can be readily combined and complemented with strongly interacting and highly selective plasmonic metasurfaces (Fig.1). Precise control of the peak response wavelength over a wide range of parameters is demonstrated by finite difference time-domain simulations together with Fourier transform infrared analysis of electron beam lithography nanofabricated devices. Whilst such devices can provide immediate significance for IR molecular sensing (CO_2, alcohol), we will also discuss the prospects of 2D hybrid metasurfaces towards quantum devices and technologies.

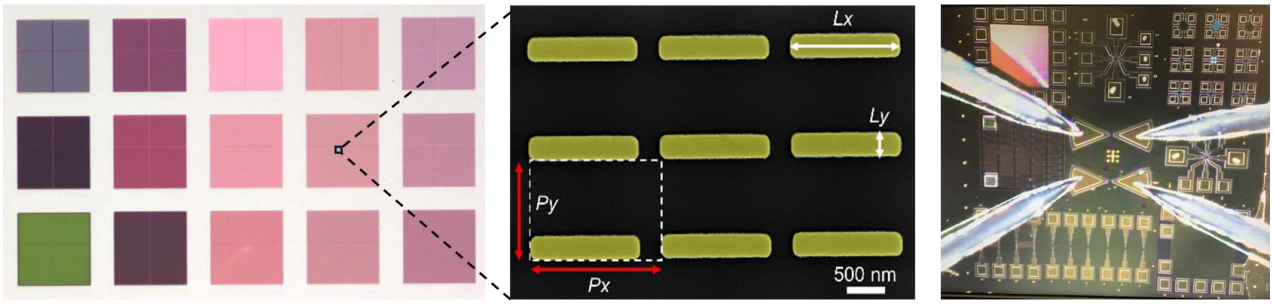

Fig.1 Electron beam lithography based nanofabrication of precision designed MIR graphene-metal hybrid metasurfaces and integrated sensor devices.

References

1. T. Yager, G. Chikvaidze, Q. Wang, Y. Fu. *Nanomaterials* 2023, 13 14, 2113.

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