2D Materials for Flat Optics and IR photonics

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Host: Professor Shen Zexiang

Abstract

Flat optics with subwavelength structures fabricated on a thin film have shown its strong power in light manipulation. It is promising for integrated optoelectronics for its compactness and compatibility for large volume manufacturing. Infrared (IR) technology has been widely used in biomedical imaging, environmental monitoring and optical communication. The mid-far-IR optoelectronics is mainly limited to compound semiconductors that normally requires intricate crystal growth process and operation at cryogenic cooling, resulting in bulky and expensive system. The emergence of two-dimensional (2D) transition metal dichalcogenides (TMDCs) offers new opportunities to flat optics and IR optoelectronics for their unique exciton behavior, strong quantum confinement and the easiness in forming heterostructures enabled by the out-of-plane van der Waals bonding. In this talk, I will introduce a special type of flat optics, the photonsieves that are constructed by hole structures in an opaque film, for applications in large field of view hologram, arbitrary orbital angular momentum vortex beam generation and manipulation, far field sub-diffraction limit focusing and label free imaging, and the high efficiency photonsieves enabled by 2D TMDCs. I will then present the observation of strong oscillator strength in interlayer excitons in two specifically selected TMDCs heterostructure and its application in room temperature operation high sensitivity mid-IR photodetection. Lastly I will give a brief introduction of tunable plasmonic responses in near IR range from 2D materials.

Short Biography

Dr. Teng Jinghua is a Principal Scientist in the Institute of Materials Research and Engineering (IMRE), Agency for Science, Technology and Research (A*STAR), and an Adjunct Associate Professor in the School of Physics and Mathematical Science, Nanyang Technological University. He received his B. Sc. in Physics and M. Sc. in Optics from Nankai University, and Ph.D. in Optoelectronics from the National University of Singapore. He has extensive experiences in both academic research and technology translation through industry collaborations. He has edited/ authored 5 book/book chapters, published over 220 journal papers, filed 29 primary patents and contributed over 250 conference presentations including many invited talks. He is an editorial board member of Journal of Optics, Journal of Physics D, Opto-Electronic Advances, PhotonIX and Journal of Molecular and Engineering Materials. His research interests include nano-optics & photonics, metamaterials and metasurfaces, 2D optoelectronics, THz technology, plasmonics, semiconductor materials and devices. He is a senior member of IEEE, OSA and SPIE.

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