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Integration of optical metamaterials and semiconductors for enhanced optical sensing


Optical metamaterials have attracted intensive attention in recent years due to their novel properties and high potential for a wide range of applications. Integration of such metamaterials with traditional semiconductors could promote that semiconductor device performance to a high level. In this keynote, I will share with you our recent work on split ring resonators (SRRs) and surface plasmon enhanced photodetection. With the electron-beam-lithography process we developed, we have demonstrated two and three dimensional SRR arrays with controllable magnetic resonances for radiations from long wave infrared to near ultraviolet and investigated their applications for biochemical sensing. By integrating metallic hole array with in AsSb based heterojunction photodiode, we have realized strong enhancement in mid-wave infrared photodetection and made them workable at room temperature. A room temperature

detectivity of 8×10^9 Jones has been demonstrated. We also invented two-terminal millimeter wave photodetectors based on fast transportation of SPP induced non-equilibrium electrons and a noise equivalent power of 1.5×10^{-13} $\text{WHz}^{-1/2}$ has been achieved.

Speaker Biography

Dao Hua Zhang received PhD degrees from the University of New South Wales, Australia. He is a professor, Deputy Director of Centre of Excellence for Semiconductor Lighting and Displays, Program Director of Photonic Nano-Structures and Application of Nanyang Technological University, Singapore. He has published over 460 papers in international journals and international conferences, 6 books and proceedings, and 3 book chapters. He also filed 3 patents. He is the editor and guest editor of about 10 international journals, including IEEE Transaction on Nano Technology, Journal of Crystal Growth, and Thin Solid Films. He is in International Advisory Committee of several international conferences and has chaired and co-chaired a number International conferences. He is a fellow of Institute of Physics, UK.

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