THE CHINESE UNIVERSITY OF HONG KONG
Department of Electronic Engineering

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Integrated subwavelength all-dielectric gratings/metasurfaces

By

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Abstract:

Subwavelength gratings/metasurface has become one of the emerging topics in the field of integrated photonics. One of the most striking advantages of a subwavelength gratings/metasurface is its full control of wave front with superior compact dimensions and has potential to be integrated with other on-chip devices. Traditional macroscopic optical elements mainly depend on refraction to control light propagation. Refraction relies heavily upon the exact curvature of the surface and the spatial extent of the element in order to achieve gradual phase accumulation. This imposes a fundamental limitation on the miniaturization of photonic devices. Subwavelength gratings/metasurfaces, a two-dimensional periodic/non-periodic array of subwavelength structure, presents a novel technique of miniaturizing photonic elements. Rather than relying on gradual phase accumulation through light propagation, each subwavelength structure imposes a discrete, abrupt change in the phase of incoming light. Previous works have only focused on the two dimensional configurations, the third dimension has been ignored so far, our recent works have revealed the importance of third dimension engineering (such as the individual phase shifter thickness and tapered sidewall profile, etc.) to fully take advantage of the full wave front control of metasurfaces; furthermore, how to realize the all-dielectric metasurfaces are also another challenging topics in the visible and near infrared wavelength range. In this talk, I will discuss our recent advances on the subwavelength reflectors and metalens: (1) Design, fabrication, characterization, and optimization of all dielectric subwavelength reflectors and metalens. The results of this research will be the foundation of (a) The development of continuous broadband achromatic metalens/reflectors, and (b) The research of metalens fabricated based on a group of low refractive index materials, even soft materials (e.g. polymers) (2) Understanding of the significant impacts with the third dimension engineering, for example, the transmission enhancement effect of tapered nanostructure and evaluation of its effectiveness and practicability on conventional high index based metalens. Our study will provide an important avenue for a series of integrated flat photonic devices for potential applications such as imaging, spectroscopy, lithography, laser fabrication, and future integrated wearable devices.

Biography:

Dr. Alex (Yasha) Yi is currently Professor and PhD program chair with University of Michigan, Department of Electrical and Computer Engineering, Dearborn campus and Energy Institute, Ann Arbor campus. He received the Ph.D. degree from the Massachusetts Institute of Technology (MIT), Cambridge, MA, USA, and was a Postdoctoral Associate with the Electronic Materials Processing Center, Massachusetts Institute of Technology, Cambridge, MA, USA, where he was involved in research on integrated nano-optoelectronic materials and devices. He had extensive research experiences with the Los Alamos National Laboratory, and the 3M Corporate Research Laboratory. He is also a Professor Affiliate with the Microsystems Technology/Microphotonics Center at MIT. He has authored more than 90 journal papers, has edited one book and written 3 book chapters, and holds 13 U.S. patents and 1 international patent. He has led several government/industry-funded projects, has been at review panel for NSF, DOE and DOD, and has been a reviewer for leading journals. His research interests are solid-state electronics and photonics, semiconducting devices, photovoltaics and energy-related optoelectronic devices, solid-state lighting (LEDs), bioinspired nano-optoelectronic structures, nanoelectronics/MEMS, and intelligent vehicle and transportation system. He is currently serving as Editorial Board Member for *Scientific Reports* (a *Nature* Research journal), Editorial Board Member for *Journal of Materials Science: Materials in Electronics* (a *Springer* Research journal) and the Vice Chair of the IEEE Southeast Michigan Section.

ALL ARE WELCOME

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