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Reflective Meta-Optics: from Broadband Response to Multiple High-Q Resonances for Low-Profile Nanophotonic Systems

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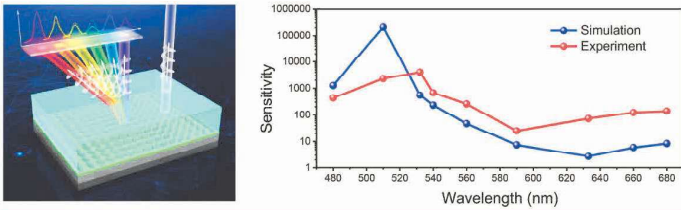


Abstract

We began from investigating the broadband response characteristics of plasmonic metasurfaces and develop plasmonic sensors to realize broadband refractive index sensing. Next, by introducing the interaction between Fabry-Pérot cavity and metasurface, the single high-Q resonance at designed wavelength was generated. Furthermore, the polarization state of the laser source can be dynamically controlled by rotating the whole microcavity. Then, a gradient-thickness DBR was introduced in metasurface to generate multiple high-Q resonances over wide wavelength range. Compared to previous studies, our approach offers a simpler design and higher working efficiency, which can be used in various applications like multi-channel holographic, structural color printing, and snapshot hyperspectral imaging systems. Therefore, benefited from its novel and breakthrough design, our research holds promise for applications in the next generation of miniaturized optoelectronic systems.

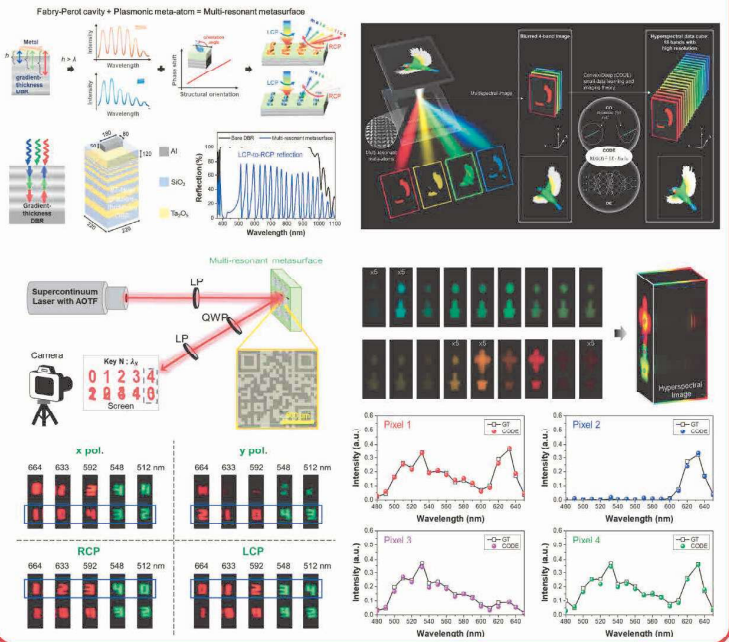
Broadband plasmonic sensor

A sensing platform based on plasmonic gradient metasurface capability of detecting the refractive index change within broad wavelength range. Through constructing the metasurface with phase gradient, both specular reflection and deflected beams can be generated in the far field simultaneously. The intensity ratio of these two beams can be calculated to analyze changes in refractive index. [1]



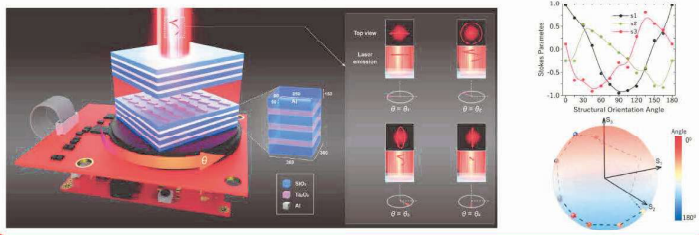
Multiple high-Q resonances

A gradient-thickness DBR was introduced in metasurface to generate multiple high-Q resonances over wide wavelength range. Compared to previous studies, our approach offers a simpler design and higher working efficiency, which can be used in various applications like multi-channel holographic, structural color printing, and snapshot hyperspectral imaging systems. [3, 4]



Metasurface-embedded microcavity laser

Taking advantage of strong optical feedback generated by Fabry-Perot microcavity, light-meta-atoms interactions can be remarkably extracted and amplified. Furthermore, the polarization state of lasing output can be actively modulated as linearly polarized or elliptically polarized at source via rotating metasurface-embedded microcavity. [2]



References

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研究生活及心得

首先由衷地感謝中技社設立此獎項，我很榮幸能讓自己的研究被評審們看到和肯定。相信大家在做研究時都是花了很多的時間和心力，過程中也難免會遇到挫折和失落的時候，所以我非常謝謝指導教授吳品韻博士一直以來的鼓勵及幫助，也感謝我的父母和實驗室夥伴們給予我許多支持和建議，他們讓我有更多的動力能在研究中不斷地堅持下去。在這，我也期許自己在未來有更豐富且更深入的研究成果能夠回饋給社會。