Mid-Infrared Metasurfaces for Biosensing and Imaging

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Abstract

Metasurfaces based on engineered dielectric and plasmonic nanostructures have recently emerged as a breakthrough platform for manipulating light at the nanoscale. They can be tailored to operate over a broad spectrum ranging from middle-infrared (Mid-IR) and ultraviolet. Mid-IR metasurfaces operating between 3-20 µm is technologically important because this spectral range includes fundamental absorption bands of chemicals and biomolecules. Infrared absorption spectroscopy taps into these "fingerprints" bands for label-free and chemical-specific biosensing [1]. Nevertheless, conventional infrared spectroscopy suffers from drawbacks such as low signals, difficulty to operate in aqueous environment and bulky and expensive instrumentation. In this talk I will describe how we address these drawbacks using dielectric and nanoplasmonic based Mid-IR metasurfaces and present our contributions to realize novel biosensors through surface enhanced infrared absorption spectroscopy (SEIRA) [2-4]. I will also present a versatile nanofabrication process enabling wafer-scale and CMOS-compatible manufacturing of efficient Mid-IR metasurfaces [5].

References:

[1] John-Herpin et al. Advanced Materials (2022)
[2] John-Herpin et al. Advanced Materials (2021)
[3] Tittl et al. Science (2018)
[4] Leitis et al. Science Advances (2019)
[6] Leitis et al. Advanced Materials (2021)