Analytical Instrumentation, Methods & Materials

METHODS FOR FABRICATING OPTICAL METASURFACES

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Overview

Optical metasurfaces enable unprecedented control over electromagnetic wave manipulation. By leveraging powerful resonance mechanisms supported by subwavelength structures arranged in two-dimensional configurations, these engineered interfaces can enable on-chip wavefront shaping, phase and direction, and polarization control. In addition to their free-space wave modulation capabilities, resonant metasurfaces can spatially and temporally confine light, generating powerful phtotonic cavities in the vicinity of resonators.

The Invention

UW-Madison researchers have developed a new class of IR metasurfaces and metasurface devices using conventional CMOS-compatible wafers and fabrication processes. The fabrication methods provide optical metasurfaces which exhibit extremely high electric field enhancements within apertures of the optical metasurfaces upon coupling light (e.g., mid-infrared light) into the optical metasurfaces. As such, the optical metasurfaces may be used in a variety of applications based on light-matter interactions, including chemical sensing and polaritonic chemistry applications. In contrast to conventional optical metasurfaces fabricated using conventional techniques, apertures of the present optical metasurfaces are fully accessible by samples present within the apertures of the optical metasurfaces and thus, enable microfluidic control of these samples. Moreover, the present methods are compatible with complementary metal-oxide-semiconductor (CMOS) processing techniques and materials, enabling more efficient and more cost¬effective industrial scale manufacturability as compared to conventional techniques.

Publications

- Adi W, Rosas S, Beisenova A, Biswas SK, Yesilkoy F.Trapping light in air with membrane metasurfaces for vibrational strong coupling.https://arxiv.org/abs/2402.17901. Epub 2024 Feb 27.

Tech Fields

- Analytical Instrumentation, Methods & Materials : Sensors
- Analytical Instrumentation, Methods & Materials : Spectroscopy
- Semiconductors & Integrated Circuits : Design & fabrication

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