

**Title:** Conformal Electrochemical Nanoimprinting of Silicon: Towards Bio-Inspired Infrared Meta-Optics

**Abstract:**

Multifunctional optical meta-surfaces (MOMS) can simultaneously deliver anti-reflective function with high thermal stability and anti-fouling behavior due to its monolithic nature (e.g., no CTE mismatch) and low dust adherence, respectively. Due to the incompatibility of semiconductor micromachining with non-planar substrates, MOMS have only been demonstrated in polymeric lenses. In this paper, a new method of conformal electrochemical nanoimprinting is presented to directly micromachine a nature-inspired sharklet pattern onto a silicon lens as both an anti-reflective and anti-fouling surface. Uniquely, this approach uses gold-coated patterned porous membranes that are used as stretchable catalytic stamps that can be inflated in conformal contact against a non-planar substrate. With the advent of design methodologies for 3D optical metasurfaces, MOMS may now be extended into lenses made of silicon, and potentially other inorganic semiconductors for applications in infrared imaging in harsh environments.