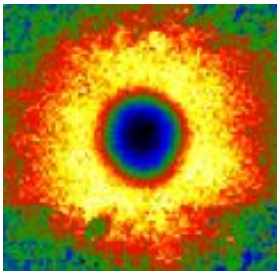

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Establishing library of metasurface building blocks through holographic microscopy

Digital holographic microscopy is a powerful tool for characterizing all-dielectric optical metasurfaces. Its ability to reconstruct amplitude and phase offers insight into the scattered-light wavefront shaping. While dielectric optical metasurfaces have garnered significant interest recently, the absence of an extensive library of building blocks based on real-world experimental data is surprising. Such a library, accounting for a complex behavior across varying geometry of building blocks and for different illumination parameters, has yet to be realized. Here, we explore this complex behavior and create such a library of rectangular TiO2 building blocks of height 500 nm and lateral dimensions ranging from 130 to 330 nm under illumination by wavelengths from 600 to 740 nm. Illumination polarization effects are studied for linearly polarized light rotating within the full range of unique polarization states (0°–180°). Finally, we study the effects of inclined illumination by varying the numerical aperture of the condenser lens from 0.05 to 0.5. Comparing the experimental results with the results of finite-difference time-domain and rigorous coupled-wave analysis simulations, we highlight their limitations and discuss the necessity of constructing a comprehensive experimental building blocks library.

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