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标题: Low-Loss Impedance-Matched Optical Metamaterials with Zero-Phase Delay

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摘要: Metamaterials have dramatically expanded the range of available optical properties, enabling an array of new devices such as superlenses, perfect absorbers, and ultrafast switches. Most research has focused on demonstrating negative- and high-index metamaterials at terahertz and optical wavelengths. However, far less emphasis has been placed on low-loss near-zero-index metamaterials that exhibit unique properties including quasi-infinite phase velocity and infinite wavelength. Here, we experimentally demonstrate a free-standing metallodielectric fishnet nanostructure that has polarization-insensitive, zero-index properties with nearly ideal transmission at 1.55 μm . This goal was achieved by optimizing the metamaterial geometry to allow both its effective permittivity and permeability to approach zero together, which simultaneously produces a zero index and matched impedance to free space. The ability to design and fabricate low-loss, near-zero-index optical metamaterials is essential for new devices such as beam collimators, zero-phase delay lines, and transformation optics lenses.

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