The Interplay of Metasurfaces and Metamaterials

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Three dimensional interconnected periodic networks made from plasmonic metals are interesting implementations of optical metamaterials that mold the flow of light in unusual ways. In particular, the templating of self-assembled polymer morphologies allows to access periodic lattice dimensions below 100 nm for the creation of metamaterials with an optical response at visible wavelengths [1,2]. In these lattices, light couples into plasmon-polariton modes which propagate across the metamaterial, coupling out into optical modes on the other side. Evidently, the in- and outcoupling at the metamaterial-surfaces play an important role in the photonic-plasmonic mode coupling.

In this presentation, the role of terminating metasurfaces of 3D metamaterials is discussed. Minute details of these surfaces can substantially modify the photonic-plasmonic mode coupling. In particular these surfaces can break the bulk symmetry and lead to localized plasmonic surface modes that do not exist in the bulk [3]. The results of our study allow to better understand the optical behavior of self-assembled metamaterials and guides their design.

References

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[3] Metasurfaces Atop Metamaterials: Surface Morphology Induces Linear Dichroism in Gyroid Optical Metamaterials, *James A. Dolan, Raphael Dehmel, Angela Demetriadou, Yibei Gu, Ulrich Wiesner, Timothy D. Wilkinson, Ilja Gunkel, Ortwin Hess, Jeremy J. Baumberg, Ullrich Steiner, Matthias Saba, Bodo D. Wilts*, Advanced Materials *31*, 1803478 (2019)

Figures

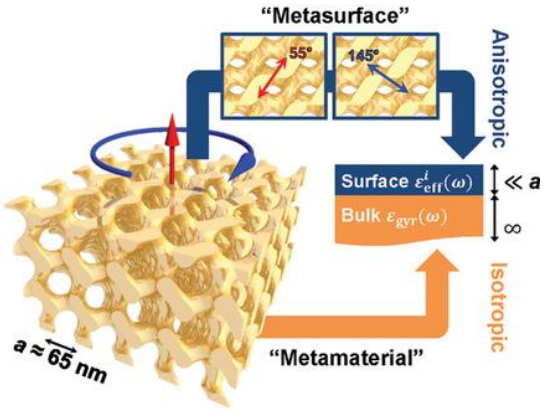

Figure 1. Interplay of metasurfaces and 3D metamaterials