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Title:Scaling of losses with size and wavelength in nanoplasmonics and metamaterials

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Abstract:We show that, for the resonant metal-dielectric structures with sub-wavelength confinement of light in all three dimensions, the loss cannot be reduced considerably below the loss of the metal itself unless one operates in the far IR and THz regions of the spectrum or below. Such high losses cannot be compensated by introducing gain due to Purcell-induced shortening of recombination times. The only way low loss optical meta-materials can be engineered is with, as yet unknown, low loss materials with negative permittivity.

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