

Optics in Lossy and Gainy Structures

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Paradoxical or at least unexpected results can occur when loss or attenuation is replaced by gain or amplification in optical structures. Total internal reflection at the interface looking into a lossy reflecting medium results in attenuation of the reflected wave. Total internal reflection from a gainy medium also results in attenuation, *not* amplification. Optical waveguides with lossy claddings exhibit evanescent wave attenuation, thus providing the basis for evanescent wave spectroscopy. Waveguides or fibers with (unbounded) gainy claddings also display attenuation, not evanescent wave gain (at least, not in the way one might expect). Understanding these and other related effects, along with the paired concepts of Fresnel and Lensef reflection, can be helpful in analyzing or designing plasmonic or nano-optic structures. Some of these fundamental ideas are also reviewed in the January 2010 issue of OSA's Optics and Photonics News.