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Nanoplasmonics and Metamaterials with Low Loss and Gain[1]

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Nanoplasmonics and Metamaterials have become an important research topic because of their interesting physics and exciting potential applications, ranging from sensing and biomedicine to nanoscopic imaging and information technology. However, many applications are hindered by one common cause – absorption loss in metal. We have shown the loss of surface plasmon can be conquered by modifying the surface structure of metal, and also can be compensated with optical gain. We also have observed the stimulated emission of surface plasmon, and demonstrated the spaser (nanolaser) supported by localized surface plasmon. We have studied the non-metallic metamaterials, which do not suffer from the damping loss of metals, including semiconductors and laser dyes. We have shown indium tin oxide (ITO) is more suitable for the nanoplasmonic applications in the infrared range than Au. We also have shown that high concentrated laser dyes exhibit negative real parts of the electric permittivity, and their dielectric functions can be controlled by laser illumination. With no doubts, such materials can revolutionize the entire technological fields of nanoplasmonics and metamaterials.

In collaboration with M. Noginov, Norfolk State University.

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