Searching for better plasmonic materials

Plasmonics is a research area merging the fields of optics and nanoelectronics by confining light with relatively large free-space wavelength to the nanometer scale - thereby enabling a family of novel devices. Current plasmonic devices at telecommunication and optical frequencies face significant challenges due to losses encountered in the constituent plasmonic materials. These large losses seriously limit the practicality of these metals for many novel applications. This paper provides an overview of alternative plasmonic materials along with motivation for each material choice and important aspects of fabrication. A comparative study of various materials including metals, metal alloys and heavily doped semiconductors is presented. The performance of each material is evaluated based on quality factors defined for each class of plasmonic devices. Most importantly, this paper outlines an approach for realizing optimal plasmonic material properties for specific frequencies and applications, thereby providing a reference for those searching for better plasmonic materials.

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