Alternative Plasmonic Materials: Beyond Gold and Silver

Materials research plays a vital role in transforming breakthrough scientific ideas into next-generation technology. Similar to the way silicon revolutionized the microelectronics industry, the proper materials can greatly impact the field of plasmonics and metamaterials. Currently, research in plasmonics and metamaterials lacks good material building blocks in order to realize useful devices. Such devices suffer from many drawbacks arising from the undesirable properties of their material building blocks, especially metals. There are many materials, other than conventional metallic components such as gold and silver, that exhibit metallic properties and provide advantages in device performance, design flexibility, fabrication, integration, and tunability. This review explores different material classes for plasmonic and metamaterial applications, such as conventional semiconductors, transparent conducting oxides, perovskite oxides, metal nitrides, silicides, germanides, and 2D materials such as graphene. This review provides a summary of the recent developments in the search for better plasmonic materials and an outlook of further research directions.

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