SURFACE PLASMON RESONANCES LOCALIZED IN SIMPLE TUNABLE PLASMONIC NANOSTRUCTURE

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Relevance. Noble metal nanomaterial's in nanomaterial research have attracted extensive attention in various fields due to their excellent optoelectronic properties and potential engineering applications. Most of these fundamental researches and applications are closely related to surface Plasmon (SP) resonances and their effects on metallic nanostructures. Surface Plasmon's are collective oscillations formed by coupling electromagnetic waves with surface electrons in metals. Surface plasmon resonance (SPR) occurs when the incident light wave matches the wavevector of surface Plasmon's on a metal surface. For small-sized metal nanoparticles, if the incident light frequency matches the SP resonance frequency of the metal nanoparticles, strong resonant absorption of photon energy occurs, known as the localized surface Plasmon resonance (LSPR) effect, which manifests as one or more distinct absorption peaks in the spectrum. Noble metal nanostructures, especially those composed of gold (Au) and silver (Ag), are commonly referred to as plasmatic nanostructures. Due to their sensitivity to the environment, structural dimensions, morphology, and composition, Au and Ag's nanostructures exhibit tunable LSPR absorption peaks and plasmatic optical effects, such as strong local electric fields, near-field enhancement, and far-field scattering. These LSPR effects not only have significant implications for fundamental research on Au and Ag nanoparticles but also demonstrate important application value in photonics, sensing and detection, optoelectronic devices, bioimaging, energy, catalysis, and other fields.

Goal of the work – The optical properties of different Au nanostructures are studied and compared with Ag nanostructures of the same morphology and size.

Result analysis – The optical properties of different Au nanostructures are studied and compared with Ag nanostructures of the same morphology and size. Generally, as the nanostructures become more elongated and the vertices become sharper, the refractive index (RI) sensitivity increases. We observed that the refractive index sensitivity does not primarily depend on the type of metal, but rather on the aspect ratio (defined as length/width) and the sharpness of the edges of the nanostructures. The dependence of refractive index sensitivity on the aspect ratio becomes more prominent as the size of the nanostructures increases.

Conclusion. Notably, the geometry control of anisotropic Au and Ag nanostructures opens up unique opportunities for us to study and will become a research hotspot.