Researchers realize controlled synthesis of Au-Ag heterodimer arrays for high-resolution encrypted information

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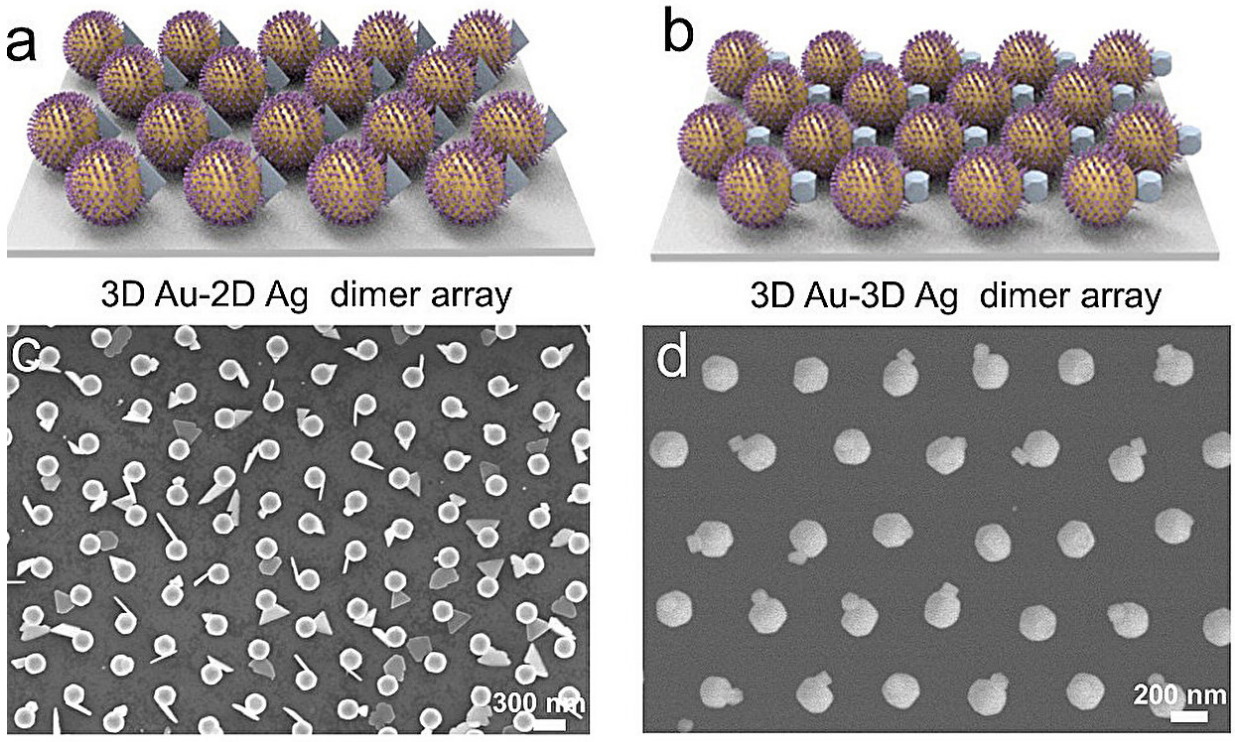

Characterization of Au-Ag dimer arrays. (a-b) Schematic of Au-Ag dimer arrays with different morphologies of Ag NPs. (c-d) SEM images of Au-Ag dimer arrays. (e-f) Dark-field optical images of patterned Au-Ag dimer arrays with line widths of 4 μm ("USTC" "ISSP"). Credit: ZENG Pan

Recently, a research group from Hefei Institutes of Physical Sciences of Chinese Academy of Sciences, developed an antielectric potential growth method for large-area preparation of Au-Ag heterodimer arrays. The prepared patterned Au-Ag dimer arrays have information resolution up to the nanometer scale due to the multipolar coupling resonance between the Au and Ag components.

The research results were published in *Nano Letters*.

The localized surface plasmonic resonance effects endow plasmonic nanoparticles (NPs) with the ability to modulate light-matter interactions , enabling patterned plasmonic arrays to encode complex colors and polarization patterns. Among them, the plasmonic heterogeneous arrays, which are composed of heterogeneous plasmonic NPs arranged periodically, have multi-dimensional optical tunability. It is conducive to the realization of high-resolution information encryption.

In this study, researchers proposed an antielectric potential strategy to realize the in situ growth of Ag NPs on Au nanosphere (NS) array to form the unique Au-Ag dimers array.

The Au NSs seed arrays were modified with the 5-amino-2-mercapto benzimidazole ligand to increase the interfacial energy, which was able to overcome the electric potential resistance between the Au NSs and the substrate for the nucleation of Ag ions. By modulating the kinetic factors, the morphology, size and number of growing Ag NPs can be precisely regulated.

Moreover, patterned Au-Ag dimer arrays were successfully prepared with the assistance of electron beam lithography. When the pattern line width is as low as 400 nm, the encrypted information can also be clearly expressed, realizing nanoscale information resolution.

This work demonstrates a facile and large-area controllable method to prepare multidimensional dimers arrays, which promotes the development of plasmonic metal arrays in the field of optical information encryption.

More information: Pan Zeng et al, Antielectric Potential Synthesis of Plasmonic Au–Ag Multidimensional Dimers Array for High-Resolution Encrypted Information, *Nano Letters* (2024). DOI: 10.1021/acs.nanolett.4c00444

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