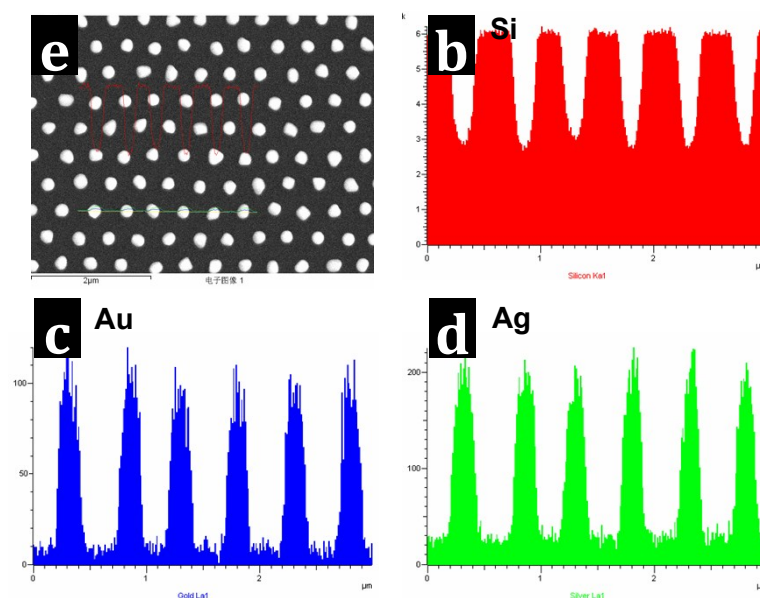


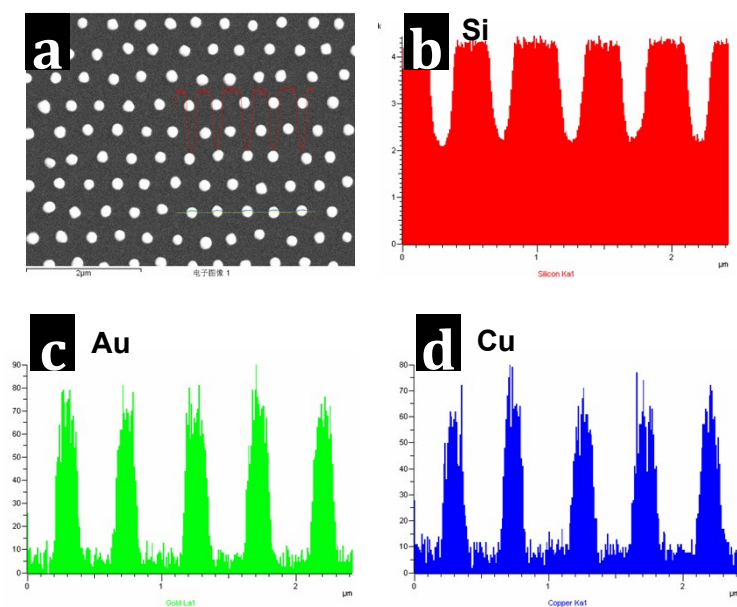
## Physical Process-aided Fabrication of Periodic Au-M (M=Ag, Cu, Ag-Cu) Alloyed Nanoparticle Arrays with Tunable Localized Surface Plasmon Resonance and Diffraction Peaks

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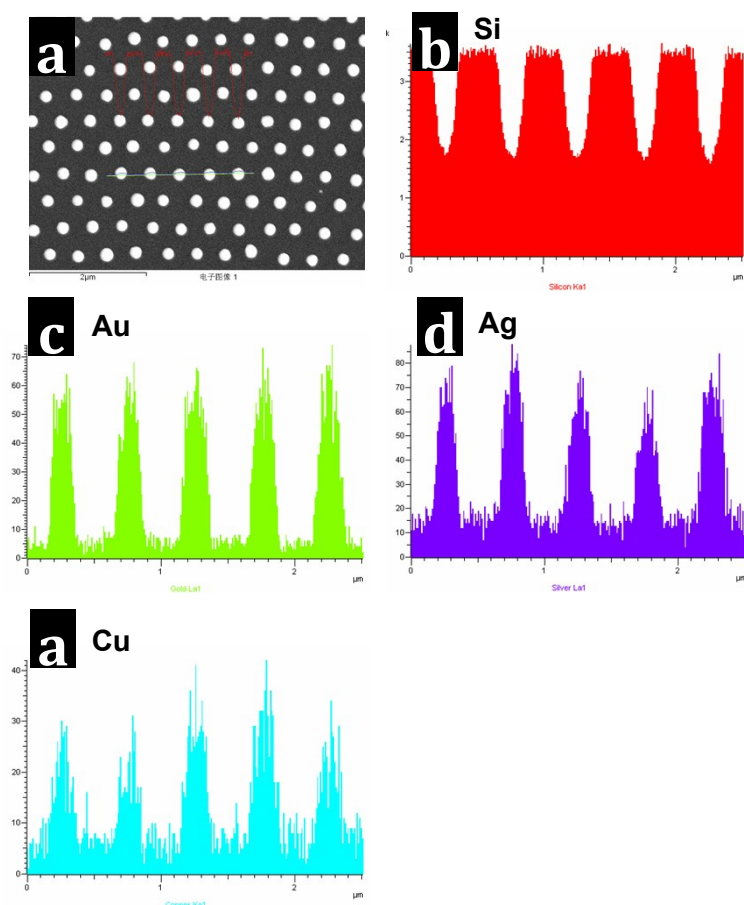
Fig. S1 shows element line-scan distributing mapping of Au-Ag alloyed metallic array films. A straight line was drawn in Au-Ag alloyed metallic arrays, as shown in Fig. S1a, silicon element was collected from substrate, under the effects of alloyed particles, the spatial distribution of silicon presented a regular change pattern opposite particle spatial distribution. Au element and silver element exhibit the same varying tendency with the particle spatial distribution, as shown in Fig. S1c and S1d, demonstrating that the nanoparticle was composed of Au and Ag element. Similarly, a straight line was drawn in Au-Cu alloyed metallic arrays, as shown in Fig. S2, according to Fig. S2c and S2d, gold and copper element were detected simultaneously at NPs location, indicating that the nanoparticle was composed of Au and Cu element. Furthermore, the nanoparticle in Fig. S3 were also demonstrated that ternary alloy Au-Ag-Cu NPs.



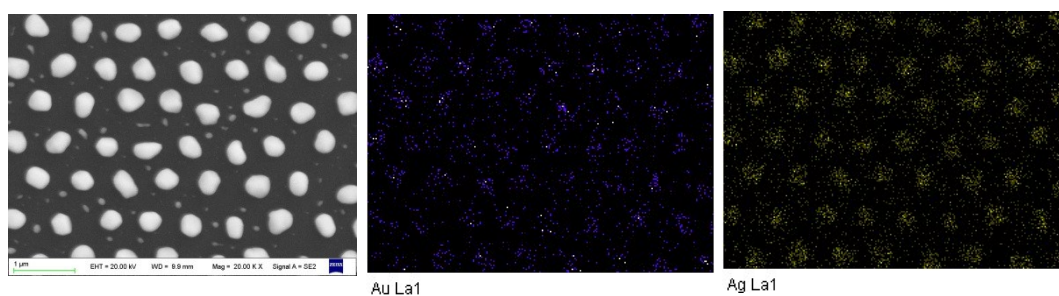
**Fig. S1** (a) SEM image of Au-Ag alloy NP arrays obtained by colloidal monolayer with periodic length of 500 nm; Element line-scanning distribution images of Au-Ag alloy NP arrays: (b) silicon element, (c) gold element, (d) silver element.



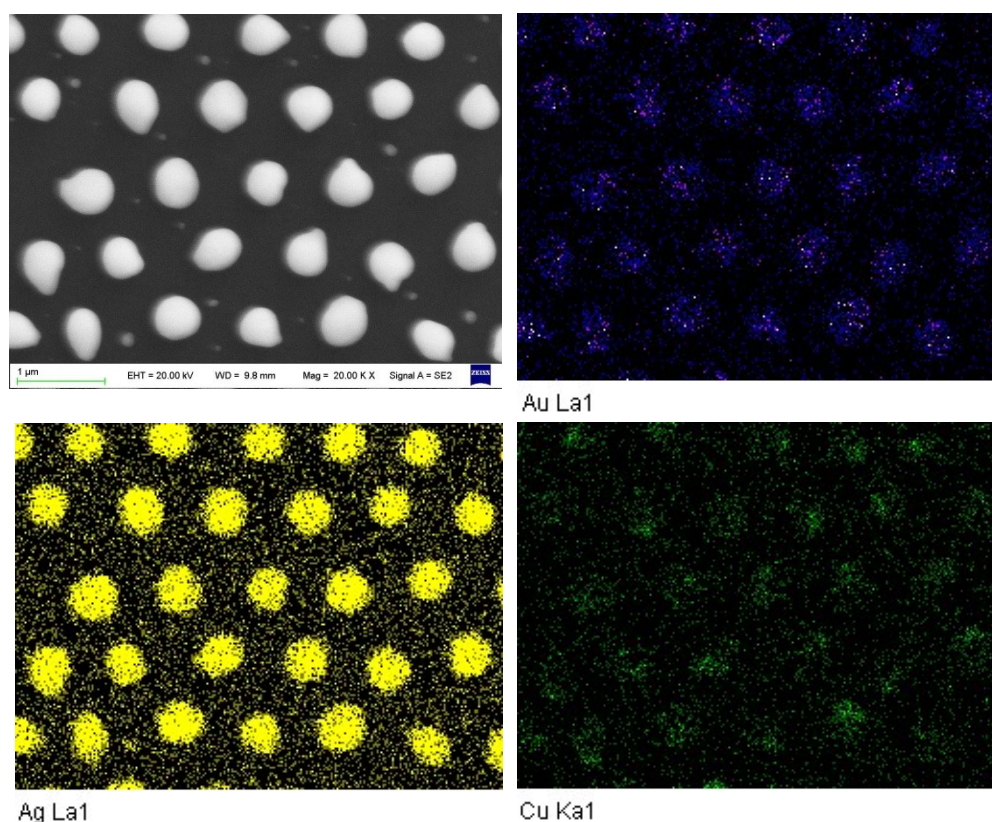
**Fig. S2** (a) SEM image of Au-Cu alloy NPs arrays obtained by colloidal monolayer with periodic length of 500 nm; Element line-scanning distribution images of Au-Cu alloy NPs arrays: (b) silicon element, (c) gold element, (d) copper element



**Fig. S3** (a) SEM image of Au-Ag-Cu alloy NPs arrays obtained by colloidal monolayer with periodic length of 500 nm; Element line-scanning distribution images of Au-Ag-Cu alloy NPs arrays: (b) silicon element, (c) gold element, (d) silver element, (e) copper element.

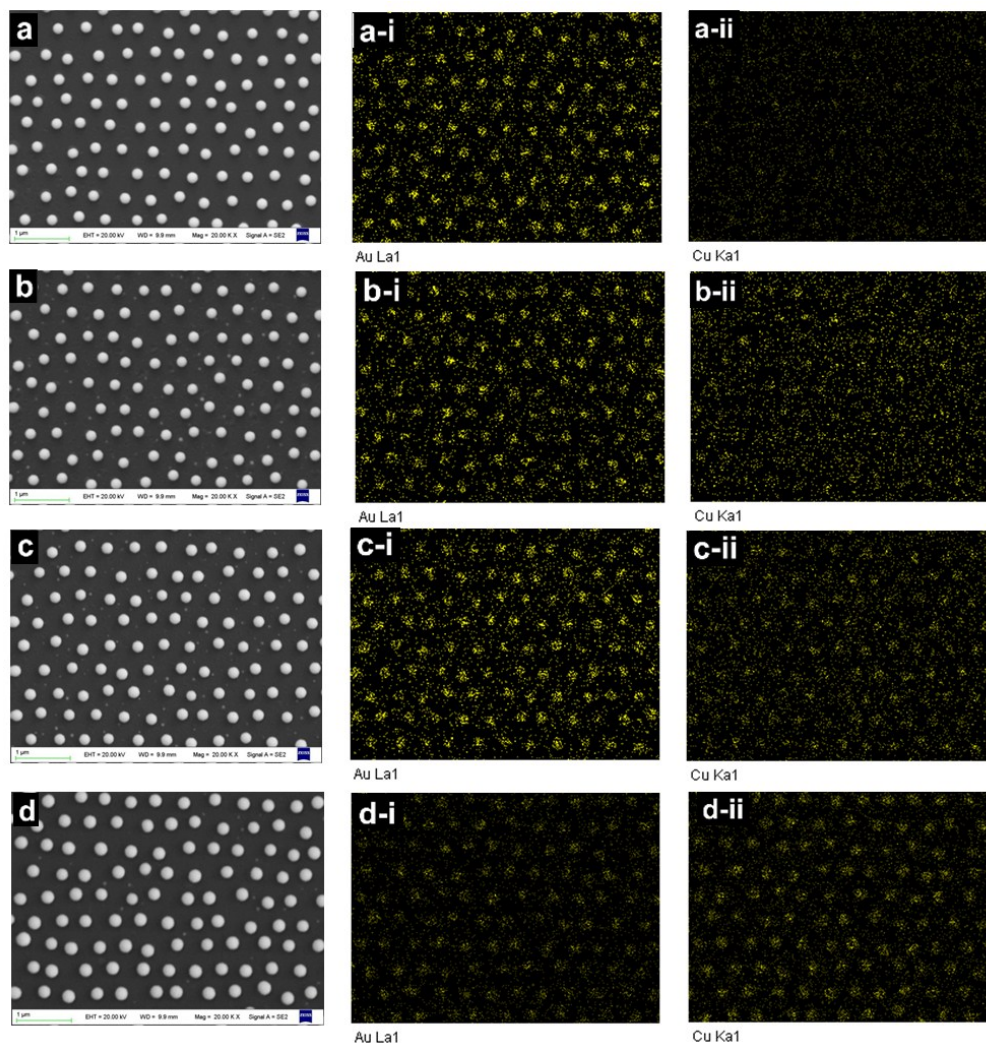


**Fig. S4** SEM images and corresponding EDS elemental distributing maps of Au-Ag NPs arrays with periodic length of 750 nm on quartz sheet from controlling deposition time of Ag film using periodic Au spherical NPs arrays as the second deposition template; In images marked a-d, the depositing time of Au, Ag film is 80 s, 40 s, respectively.

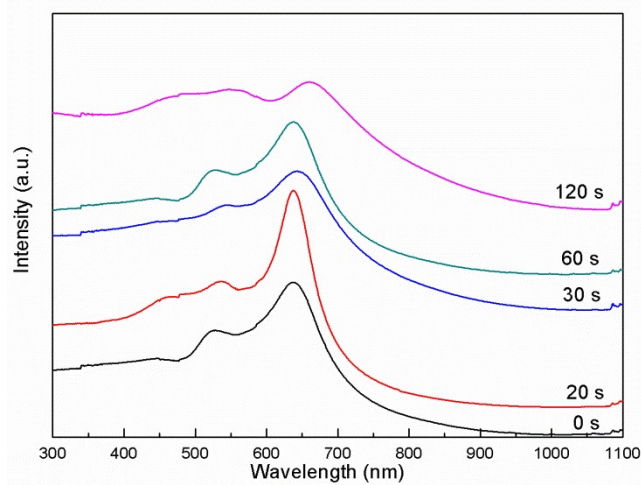


**Fig. S5** SEM images and corresponding EDS elemental distributing maps of Au-Ag-Cu NPs arrays with periodic length of 1000 nm on quartz sheet from controlling deposition time of Ag and Cu film using periodic Au spherical NPs arrays as the second deposition template; the depositing time of Au, Ag and Cu film is 80 s, 80 s and 80 s, respectively.





**Fig. S6** SEM images and corresponding EDS elemental distributing map of sphere-shaped Au-Cu NPs arrays with periodic length of 500 nm on quartz sheet with varying Cu content by controlling deposition time of Ag film using periodic Au spherical NPs arrays as the second deposition template; In images marked a-d, the depositing time of Cu film is 20, 30, 60 and 120 s, respectively.



**Fig. S7** Extinction spectrum of Au-Cu alloyed NPs arrays with different sizes caused by depositing increasing time of Cu film using periodic Au spherical NPs arrays as the second deposition template.