

Supplementary Information

Selective control of fcc and hcp crystal structures in Au–Ru solid-solution alloy nanoparticles

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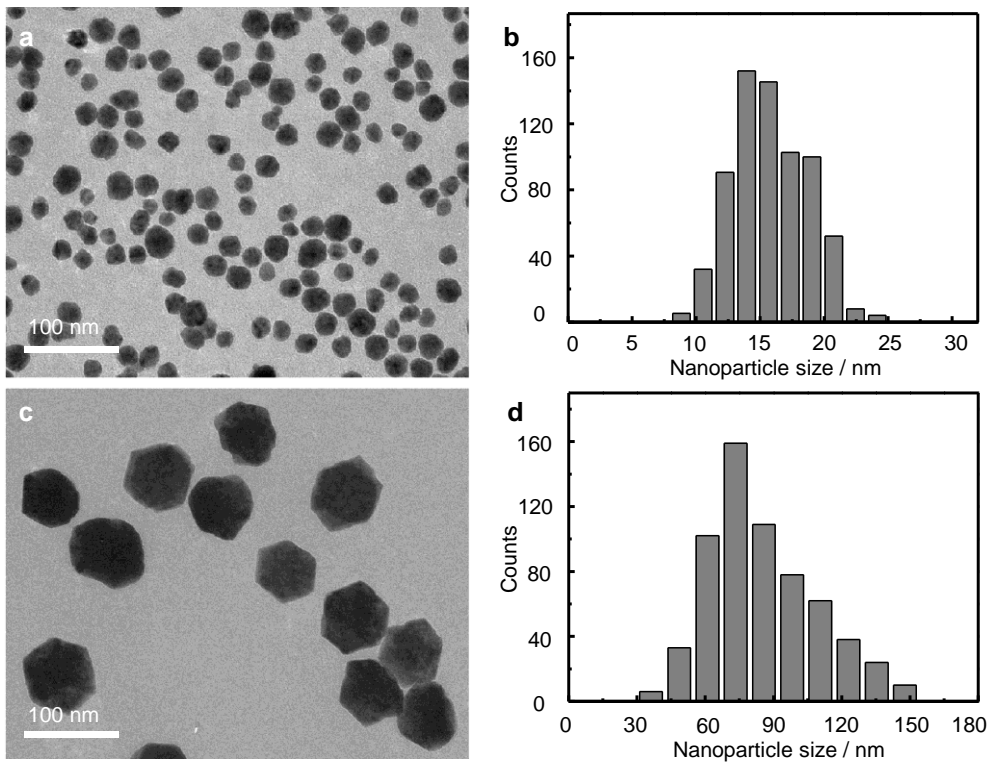
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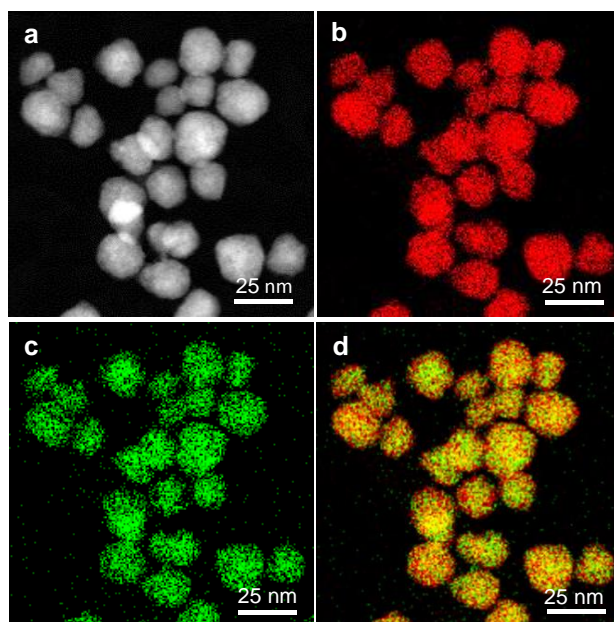
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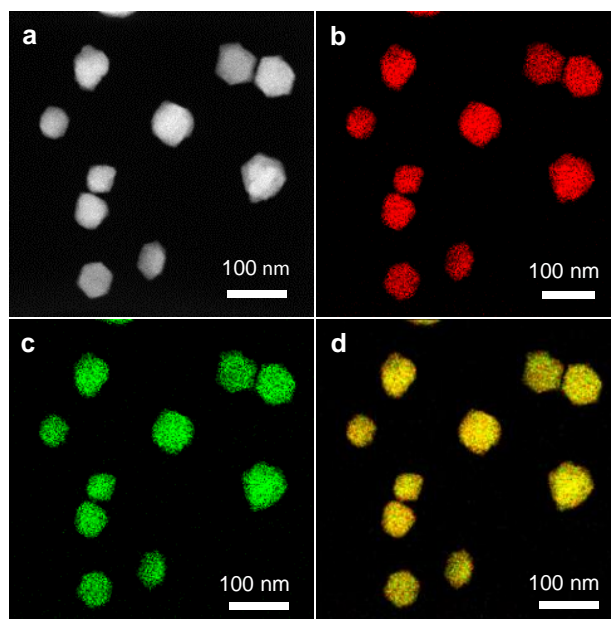
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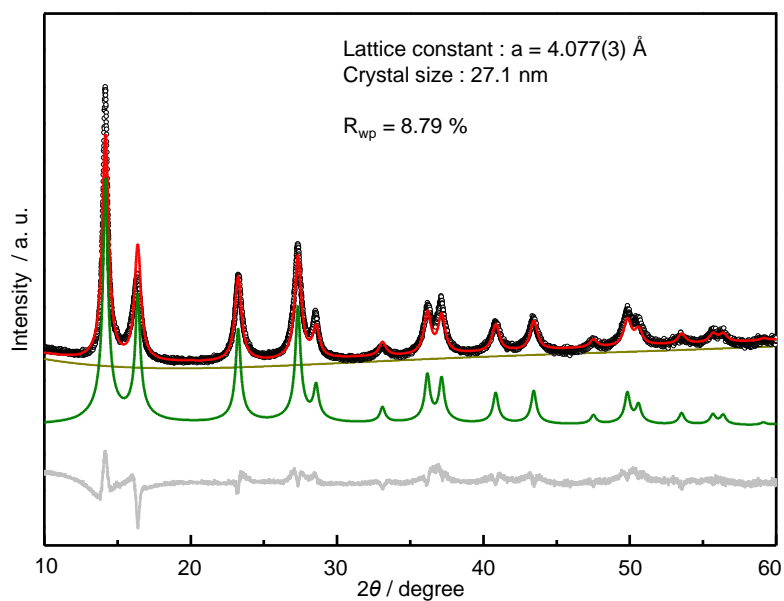
Supplementary Figure 1. (a) TEM image of the synthesized fcc-AuRu₃ NPs. (b) Size distributions of the nanoparticles in (a). (c) TEM image of the synthesized hcp-AuRu₃ NPs. (d) Size distributions of the nanoparticles in (c).



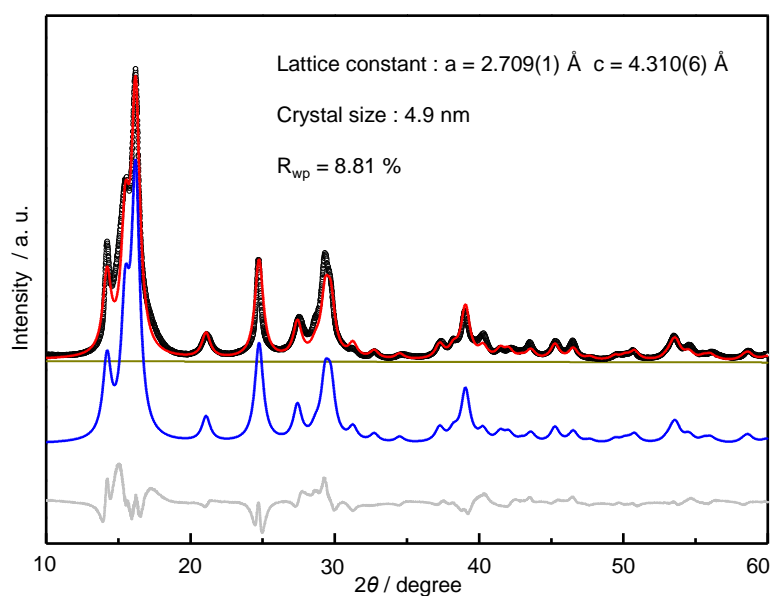
Supplementary Figure 2. (a) Low magnification HAADF-STEM image of fcc-AuRu₃ NPs. (b) Ru-L STEM-EDX map of (a). (c) Au-M STEM-EDX map of (a). (d) Overlay image of (b) and (c) (red, Ru; green, Au).



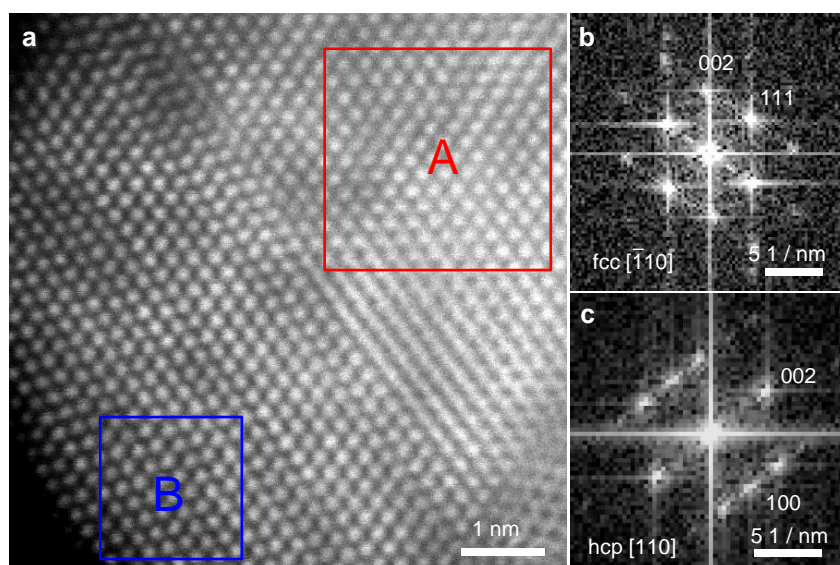
Supplementary Figure 3. (a) Low magnification HAADF-STEM image of hcp-AuRu₃ NPs. (b) Ru-L STEM-EDS map of (a). (c) Au-M STEM-EDX map of (a). (d) Overlay image of (b) and (c) (red, Ru; green, Au).



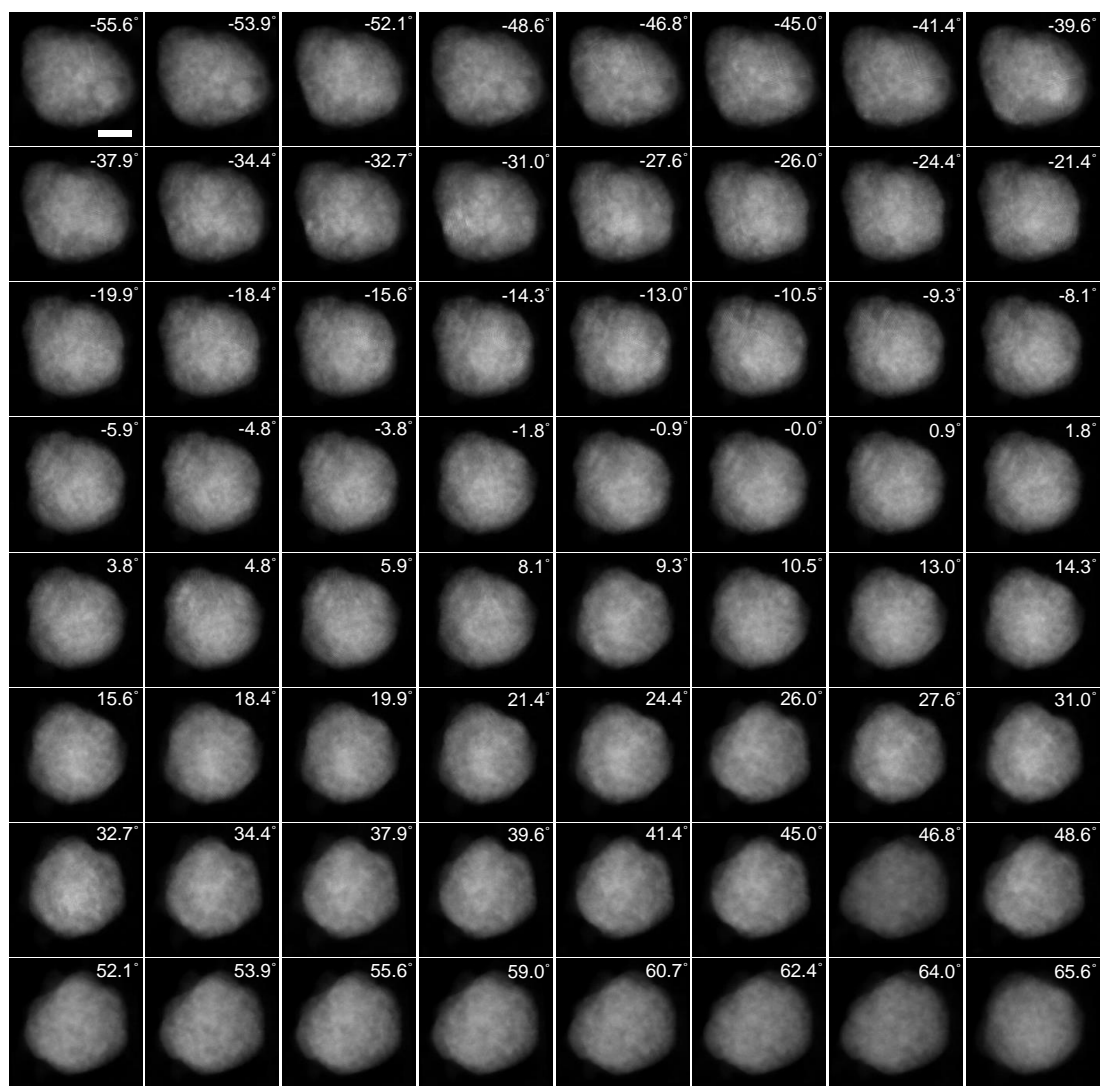
Supplementary Figure 4. Rietveld refinement for Au NPs. The diffraction patterns are shown as black circles. The calculated patterns are shown as red lines. The difference profile, the background profile, and the fitting curves of the fcc components are shown as grey, brown and green lines, respectively.



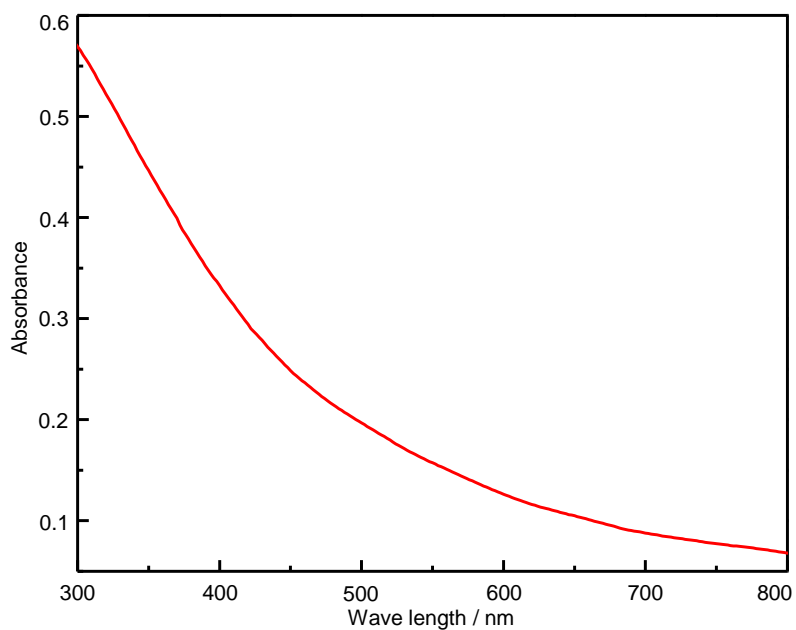
Supplementary Figure 5. Rietveld refinement for Ru NPs. The diffraction patterns are shown as black circles. The calculated patterns are shown as red lines. The difference profile, the background profile, and the fitting curves of the hcp components are shown as grey, brown and blue lines, respectively.



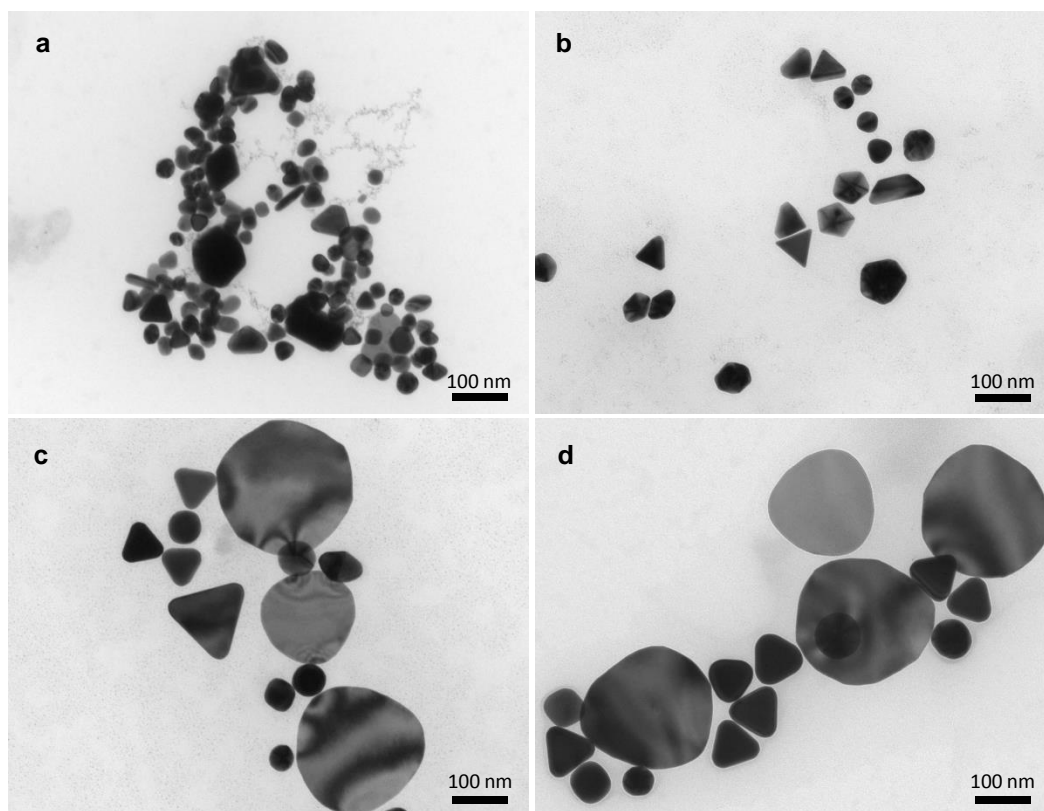
Supplementary Figure 6. (a) Low magnification HAADF-STEM image of the fcc-AuRu₃ NP. (b) The corresponding FFT pattern of the red square region A in (a). (c) The corresponding FFT pattern of the blue square region B in (a).



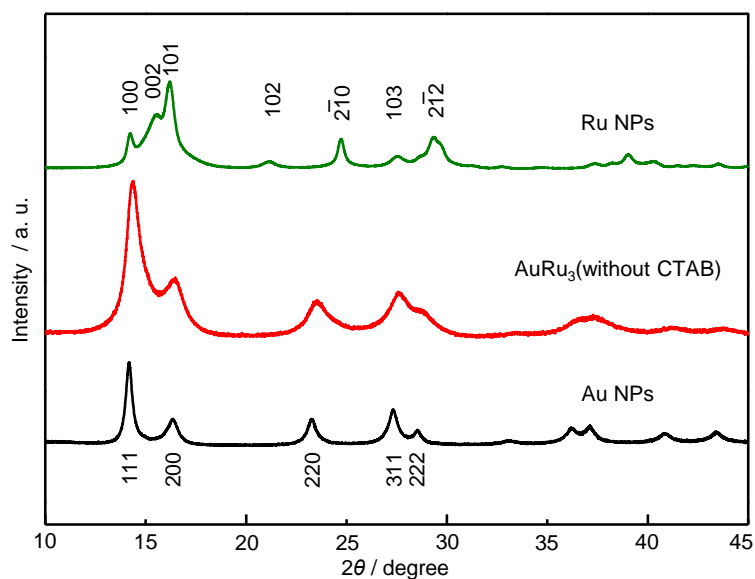
Supplementary Figure 7. Experimental tilt series obtained from a fcc-AuRu₃ NP. 64 projection images with a tilt range from -55.6° to +65.6° were measured using a JEM-ARM200F operated at 120 kV. The scale bar is 5 nm.



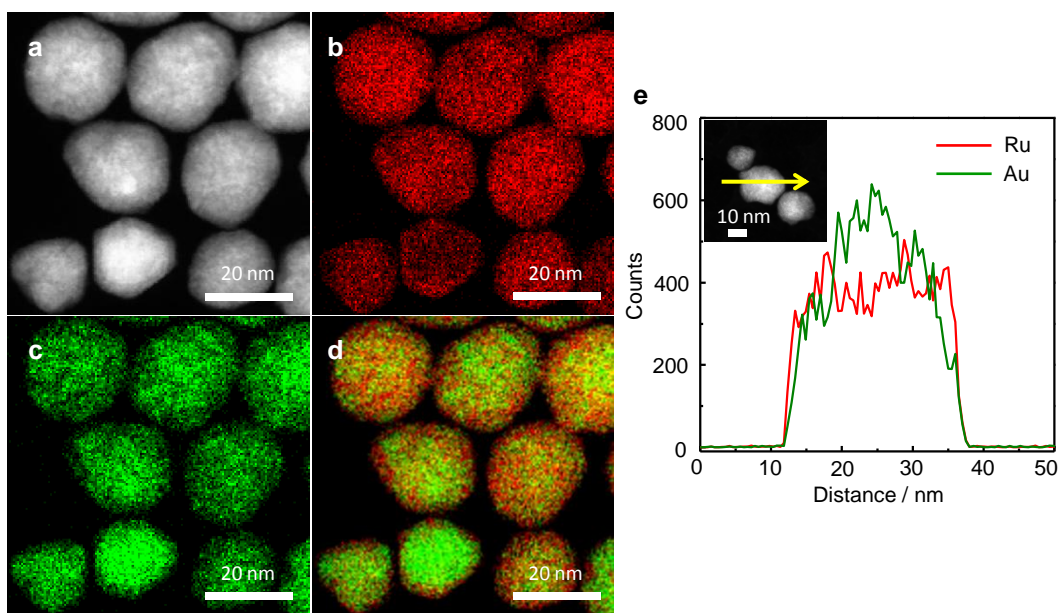
Supplementary Figure 8. UV-Vis spectrum of Ru NPs in the EG solution. The concentration of Ru NPs is 0.04 mg ml^{-1} .



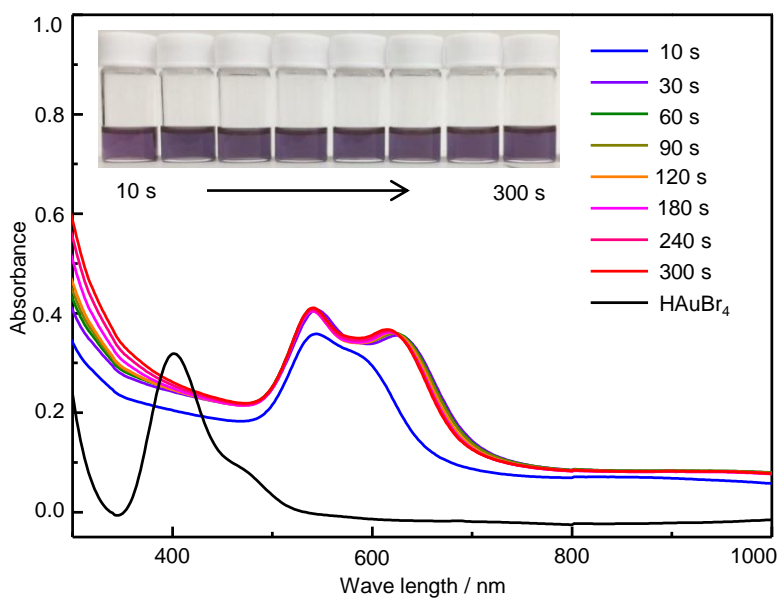
Supplementary Figure 9. TEM images of Au NPs at different reaction time during the reduction process of HAuBr_4 with CTAB in DEG. (a) 90 s, (b) 120 s, (c) 180 s, (d) 240 s.



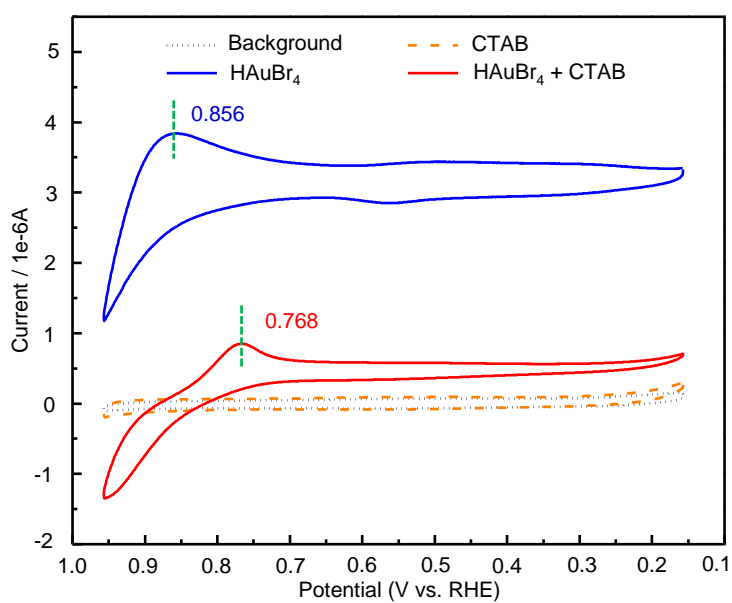
Supplementary Figure 10. Synchrotron XRD patterns of AuRu₃ NPs prepared using HAuBr₄ and RuCl₃ as metal precursors without using CTAB at 303 K. The radiation wavelength was 0.57865(1) Å.



Supplementary Figure 11. (a) HAADF-STEM image of AuRu₃ NPs (synthesized using HAuBr₄ and RuCl₃ as metal precursors without using CTAB), (b) Ru-L STEM-EDX map and (c) Au-M STEM-EDX map. (d) Overlay image of (b) and (c) (red, Ru; green, Au). (e) EDX line profiles of AuRu₃ NPs across the NP along the arrow shown in the inset figure.



Supplementary Figure 12. UV-Vis spectra of HAuBr₄ in DEG with increasing reaction time. Insert photo shows the colour change during this process.



Supplementary Figure 13. Cyclic voltammograms of HAuBr₄ and HAuBr₄ with CTAB.

The cyclic voltammograms were measured in a 0.05 mmol L⁻¹ sulfuric acid aqueous solution at 0.02 V s⁻¹.