

Electronic Supplementary Information

Liesegang rings of dendritic silver crystals emerging from galvanic displacement reaction in liquid-phase solution

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Characterisation. The Ag dendrite crystals were identified by powder X-ray diffraction (XRD) and X-ray photoelectron spectrum (XPS). The XRD patterns were recorded on a DX-1000 powder X-ray diffractometer (Dandong Fangyuan Instrument Co., Ltd., Dandong, China) with Cu K α radiation from 30 to 90° (2 θ) with a scanning step of 0.05°. The XPS was recorded on a Kratos XSAM 800 X-ray photoelectron spectrometer (Manchester, UK) operated in fixed analyser transmission mode using non-monochromatic Al K α (1486.6 eV) radiation. The applied voltage and current were 12 kV and 15 mA, respectively. The peak curve fitting was accomplished by a XPS peak 2.0 software. All the peaks were corrected with the C 1s peak at 284.8 eV as the reference. The scanning electron microscopic (SEM) images were captured by a LEO 1530 field emission SEM (LEO Elektronenmikroskopie GmbH, Oberkochen, Germany) at an accelerating voltage of 20 kV. The growth process of Liesegang rings of Ag dendrites was recorded under an M-LCD video zoom microscope (View Solutions Inc., Beijing, China). The Raman spectra were captured with a Nicolet Almega XR dispersive Raman spectrometer (Thermo Fisher Scientific, Madison, WI, USA). During measurements, an excitation light beam of 532 nm from an air-cooled argon ion laser source operating at 25 mW was focused onto various spots of the sample on a microscope stage through a 10 \times objective with 4 s exposure time. The Raman spectra were recorded at 500–1700 cm⁻¹.

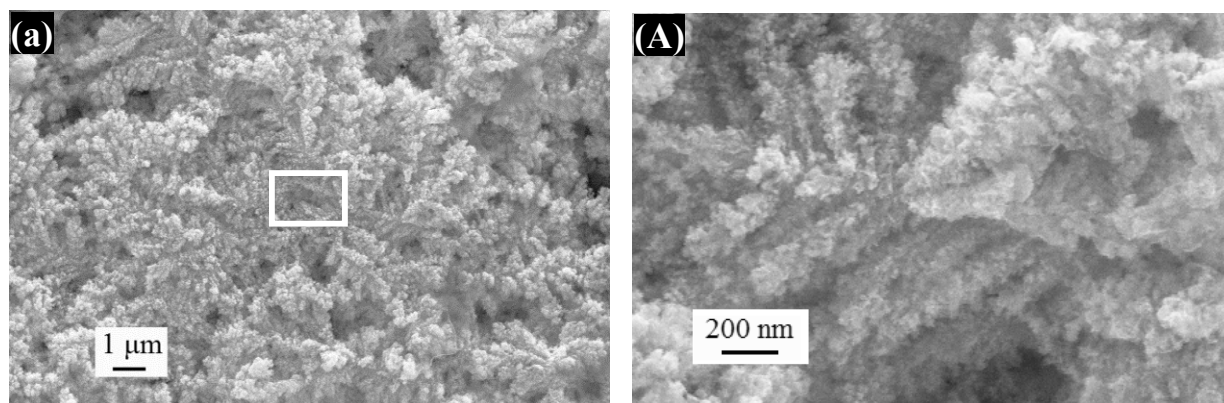


Fig. S1 (a) Lower SEM images of AgNPs on the edge of Zn plate obtained in 5.0 mM Ag_2SO_4 aqueous solution at reaction time of 1.0 min. (A) Higher magnification SEM image of the area indicated by the white rectangle in (a). SEM images were captured in the area indicated by the red circle in Fig. 1.

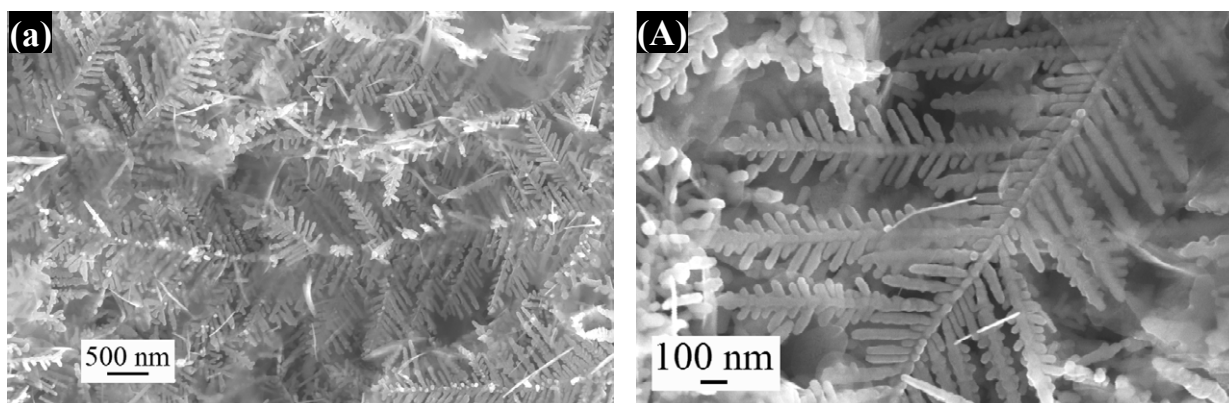


Fig. S2 (a) Lower and (A) higher magnification SEM images of Ag dendrites from the edge of Zn plate obtained in 5.0 mM Ag_2SO_4 aqueous solution at reaction time of 3.0 min. SEM images were captured in the area indicated by the white circle in Fig. 1.

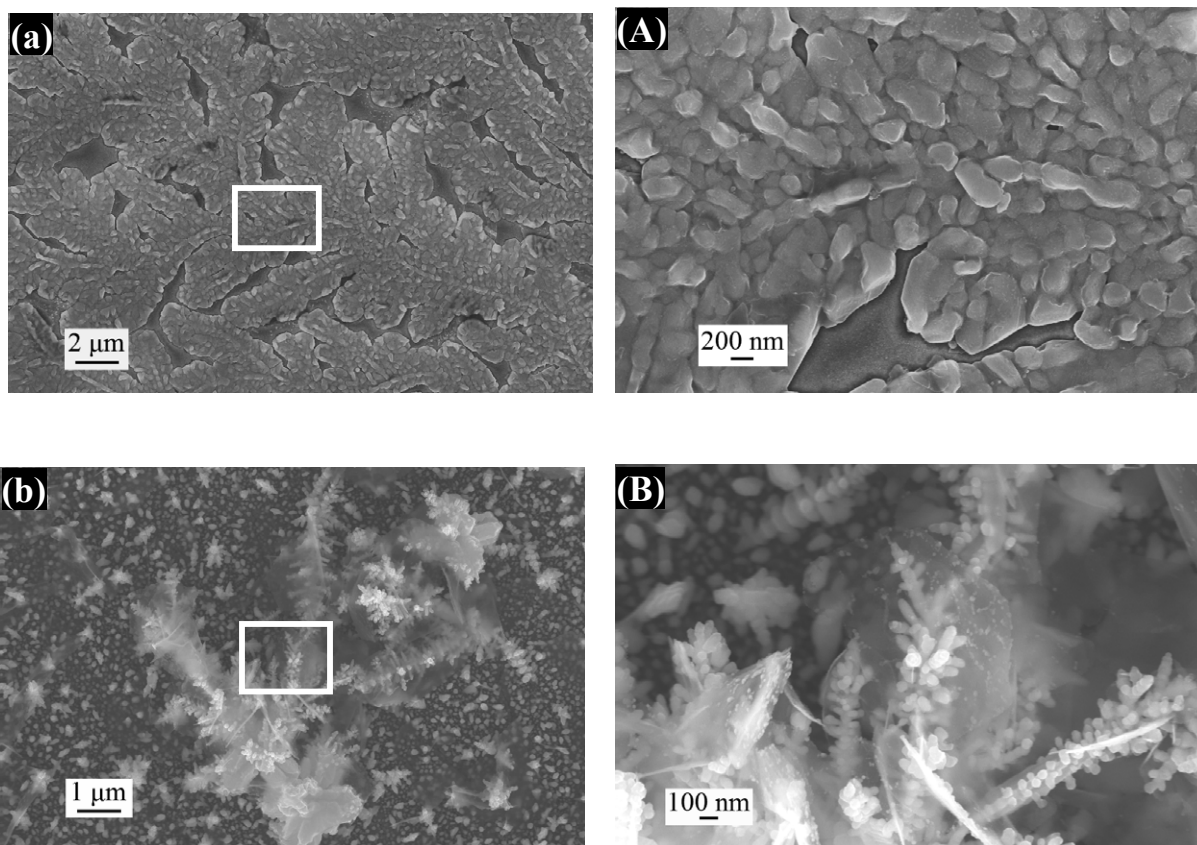


Fig. S3 SEM images of various Ag dendrites emerging from Zn plate obtained in 5.0 mM Ag_2SO_4 aqueous solution at reaction time of 10 min. Panel A and B are higher magnification SEM images of the areas indicated by the white rectangles in (a) and (b), respectively. SEM images were captured in the area indicated by the red rectangle in Fig. 1.

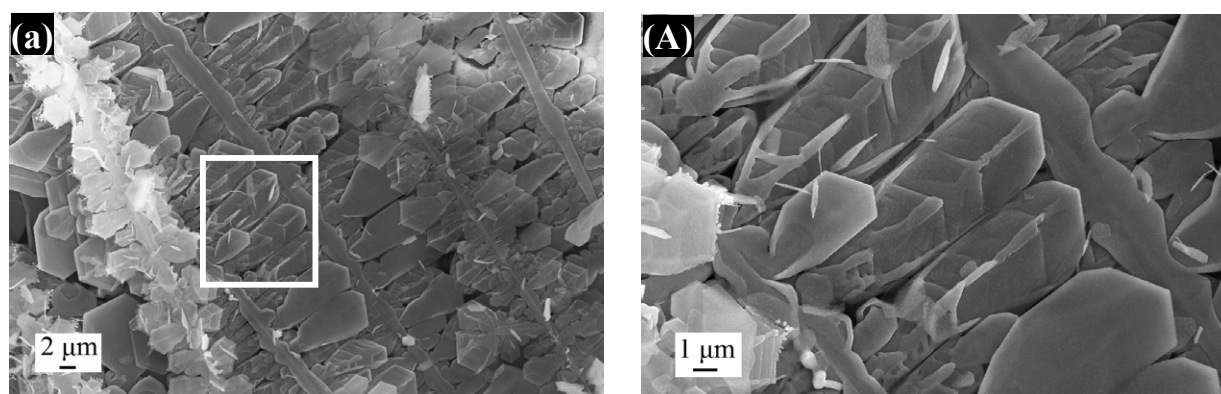


Fig. S4 (a) SEM image of Ag dendrites obtained in 5.0 mM Ag_2SO_4 aqueous solution at reaction time of 70 min. Panel A is higher magnification SEM image of the area indicated by the white rectangles in (a). SEM images were captured in the area indicated by the black rectangle in Fig. 1.

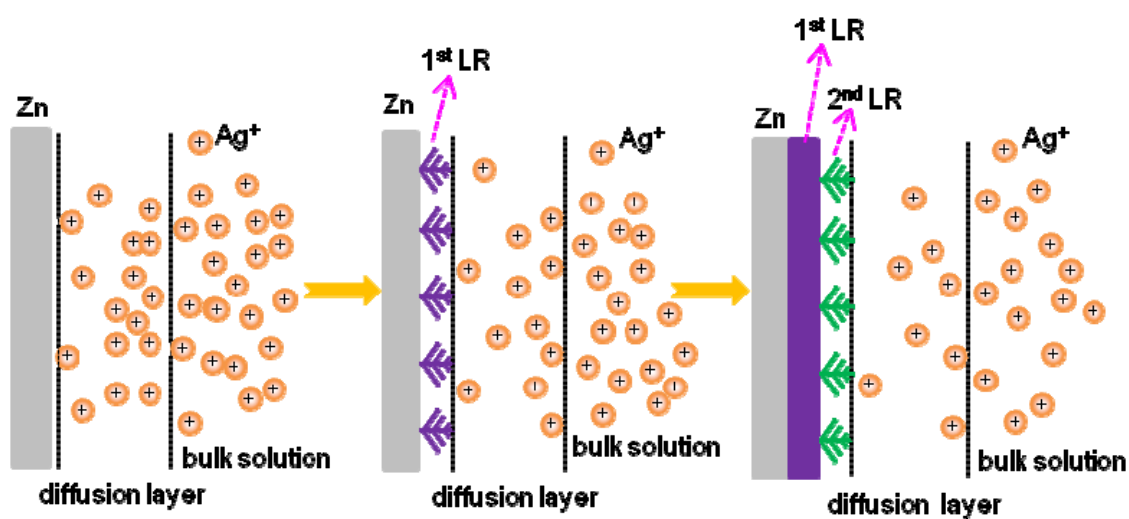


Fig. S5 Schematic diagram illustrates the reaction-diffusion and formation process of LR of Ag dendrites.

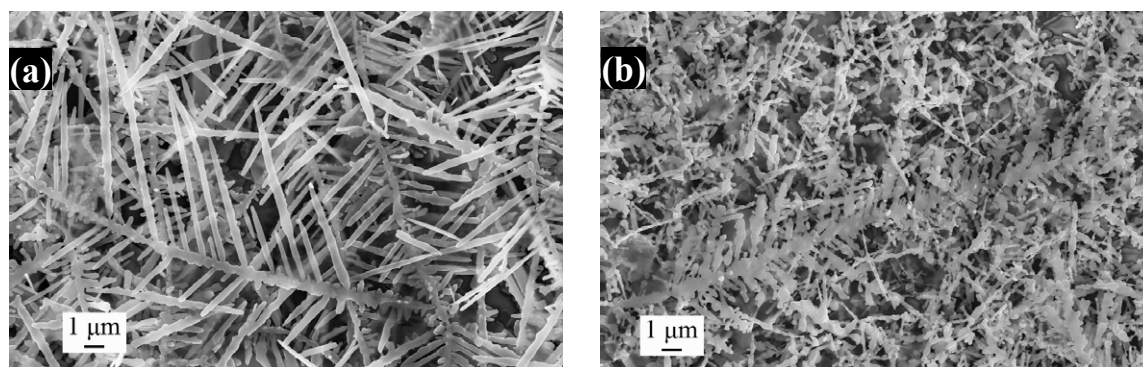


Fig. S6 SEM images of various black Ag dendrites obtained in 5.0 mM Ag₂SO₄ aqueous solution at reaction time of 90 min. SEM images were captured in the area indicated by the red triangle in Fig.1

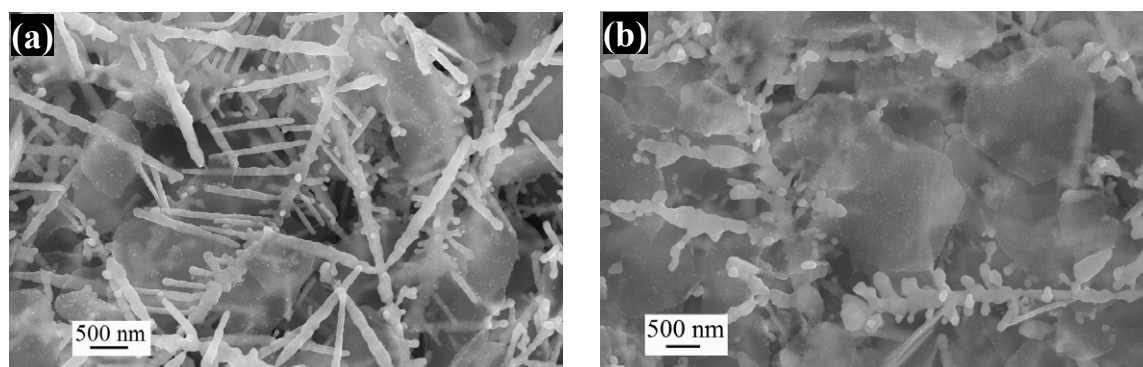


Fig. S7 SEM image of various grey Ag dendrites obtained in 5.0 mM Ag₂SO₄ aqueous solution at reaction time of 150 min. SEM images were captured in the area indicated by the black triangle in Fig. 1.

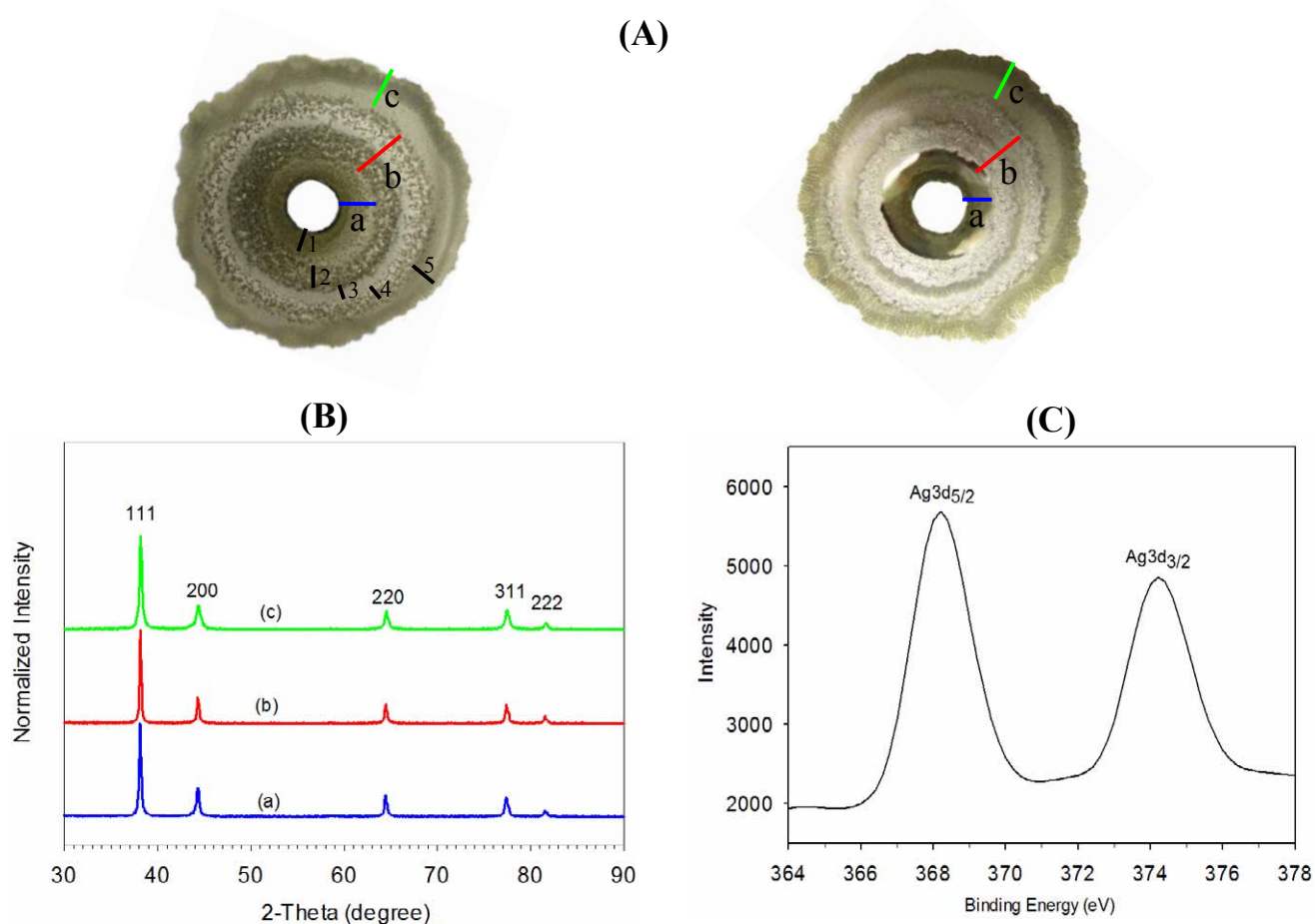


Fig. S8 (A) Photographic images of Liesegang rings of dendritic Ag crystals at the top and bottom views after reaction time of 150 min. (B) XRD pattern of the Ag dendrites at different rings indicated in (A): (a) the inner rings (marked with blue line), (b) middle rings (marked with red line) and (c) outer rings (marked with green line). (C) XPS of Ag dendrites with binding energies of 368.1 eV for Ag 3d_{5/2} and 374.1 eV for Ag 3d_{3/2}. All the Ag dendrites were obtained from 5.0 mM Ag₂SO₄ at reaction time of 150 min.

Web-enhanced object: Videos real-time record the growth of LR of Ag dendrites. “Video 1” is the normal play time and Video 2 is 10 times faster than the normal play time.