

Supporting Information

For

Preparation and Characterization of Highly Planar Flexible Silver Crystal Belts

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EXPERIMENTAL SECTION

Materials: PEG ($M_w = 2,000,000$, or $50,000$ g/mol), TEMED, AgNO_3 (1 M solution), PVP, and PAA were purchased from Wako Pure Chemical Industries, Japan. Nonionic surfactant ChEO₁₅ was received as a gift sample from Nihon Emulsion, Japan. All the chemicals were used as-supplied. Highly pure deionized water (Milli-Q) was used for all the experiments.

Preparation of Ag belts: In a typical procedure, a clear solution was first prepared by mixing PEG (0.1 g) with water (10 g) in a 20-mL thick-walled glass-tube reactor by continuously stirring for 5 h. Afterwards, AgNO_3 (500 μL of 1 M) was added with stirring for 5 min. Then, TEMED (250 μL) was drop wise added under vigorous stirring for 5 min. Ag^+ ions were immediately reduced to Ag^0 particles in the PEG dispersion upon the addition of TEMED, as indicated by the change in the color of the dispersion. Next, the thick-walled glass-tube reactor was sealed with a cap and left in dark under static

conditions at 25 °C. Long, crystalline, and highly luminescent Ag belts spontaneously formed within 1–2 weeks because of crystal growth. The resulting precipitated Ag samples were subsequently washed 4–5 times with water and ethanol to remove organic residues. Similar experiments were carried out by varying the content of the reactant, temperature, and PEG molecular weight.

Characterization: The mean size, size distribution, and morphology of the Ag belts were examined by observing the dried product on a glass slide using SEM (Hitachi) operated at an accelerating voltage of 20 kV. TEM and HR-TEM characterizations were performed with an electron microscope model JEM–2200TFE, JEOL, operating at 200 kV. EDX analysis was performed with the scanning transmission electron microscopy (STEM) detector of the device JEOL JEM–2200TFE at 200 kV. The XRD patterns of the Ag belts were obtained at room temperature using a Rigaku SmartLab X-ray diffractometer with monochromatic Cu K α radiation (40 kV, 100 mA). XPS was recorded on an ESCALab MKII X-ray photoelectron spectrometer equipped with a Mg K α excitation radiation source. The energy calibration and the deconvolution of the XPS peaks were calculated employing the XPS_{peak} 4.1 software. The Raman spectra were detected by a LabRAM HR-800 microspectrometer connected to a Leica microscope with an objective lens of 100 $\times$ (NA = 0.90). The peaks were obtained at a laser power of 2 mW, an accumulation time of 10 s, and an excitation wavelength of 458 nm (Ar). TGA was carried out on a Seiko Instruments Model SSC/5200 apparatus. The TGA measurements were made in the range 30–800 °C (at a rate of 10 °C/min) under air flowing at a rate of 200 mL/min.

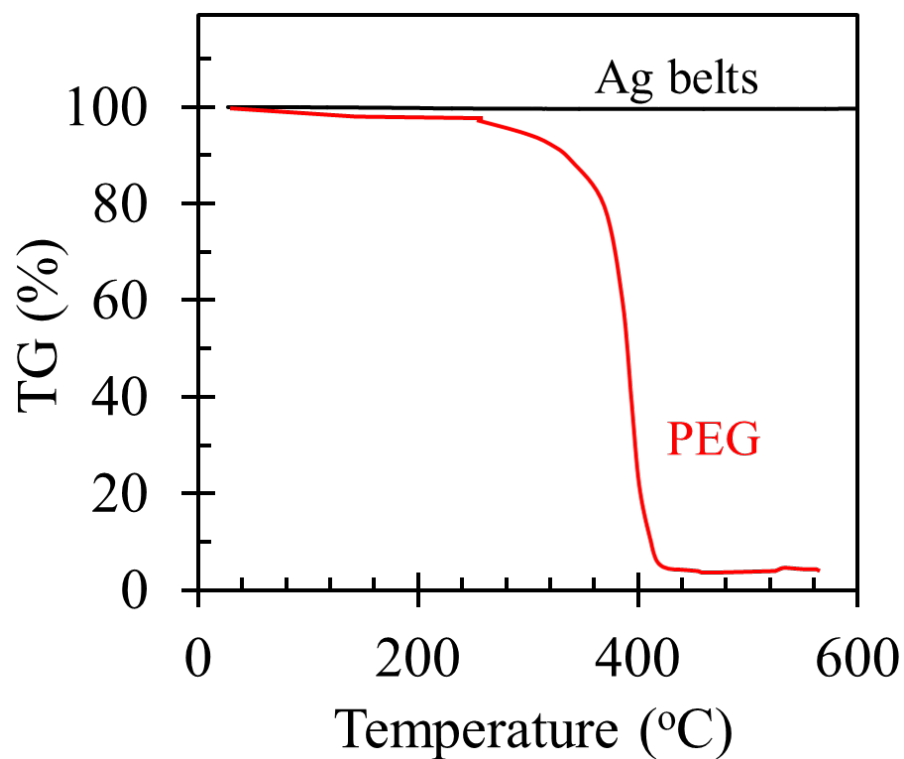


Figure S1: TGA measurements of the as-prepared Ag belts (black) and starting PEG material (red) to confirm the absence of any PEG in the Ag material.

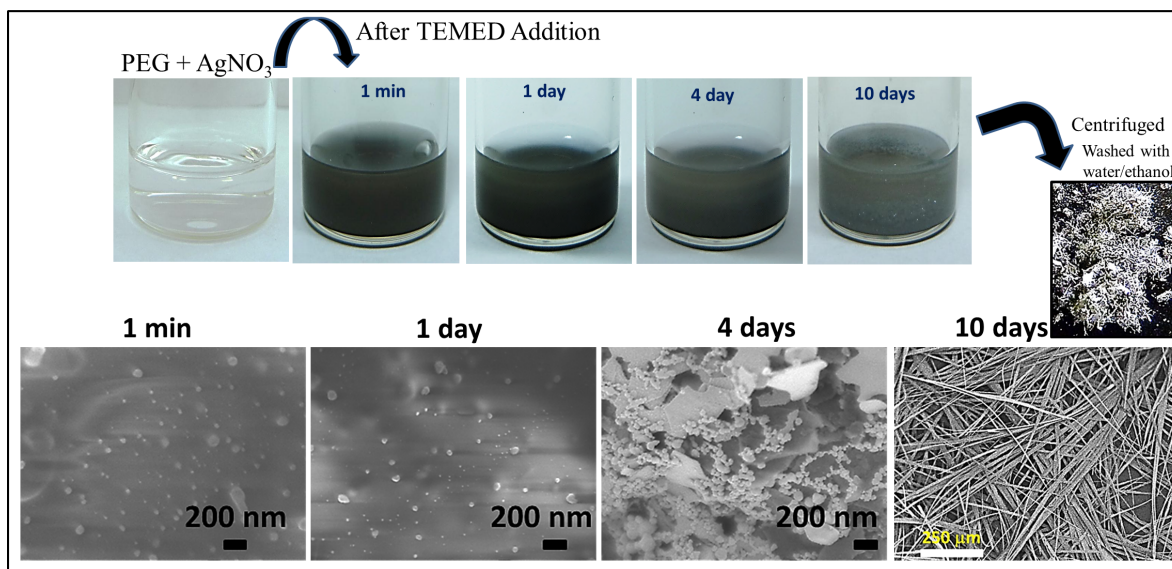


Figure S2. Optical images and corresponding SEM images showing the evolution of solution state with respect to time (1 min, 1 day, 4 days, and 10 days) after addition of TEMED (250 μ L) in PEG (10 g; 1 wt%) + AgNO₃ (500 μ L; 1 M). Scale bars in SEM images for 1 min, 1 day, and 4 days depict 200 nm, while the scale bar for 10 days represents 250 μ m.

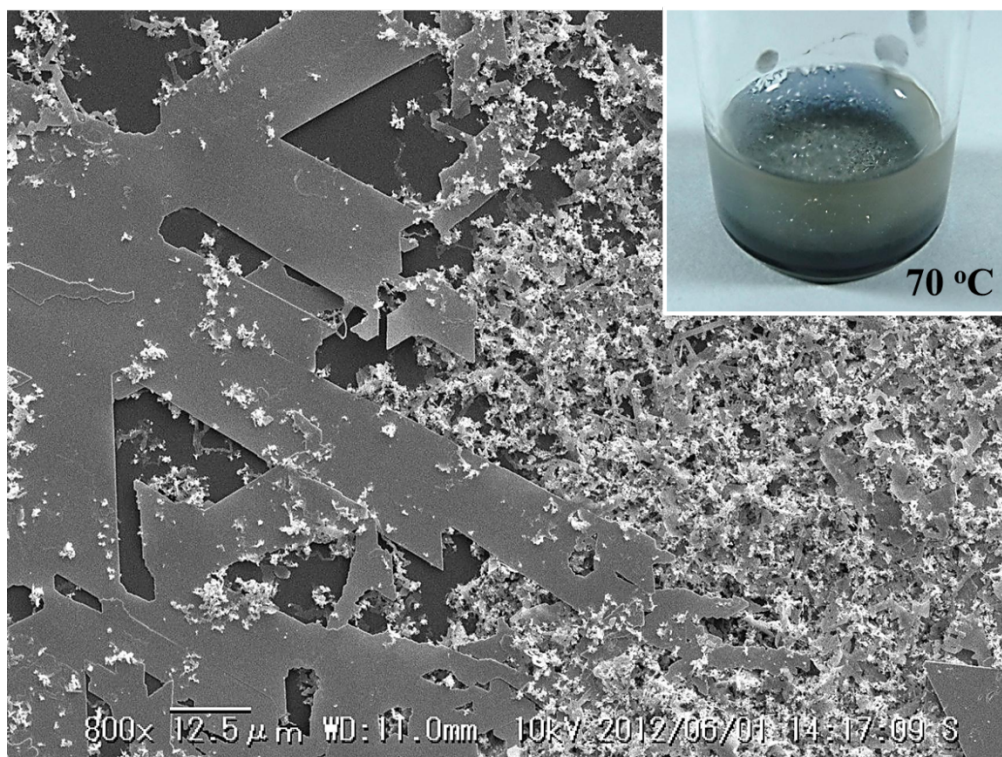


Figure S3: Typical SEM image of the Ag nanomaterial synthesized in PEG (10 g; 1 wt%) + AgNO₃ (500 μL; 1 M) + TEMED (250 μL) at 70 °C. The inset shows an optical image representing the luminescent product.

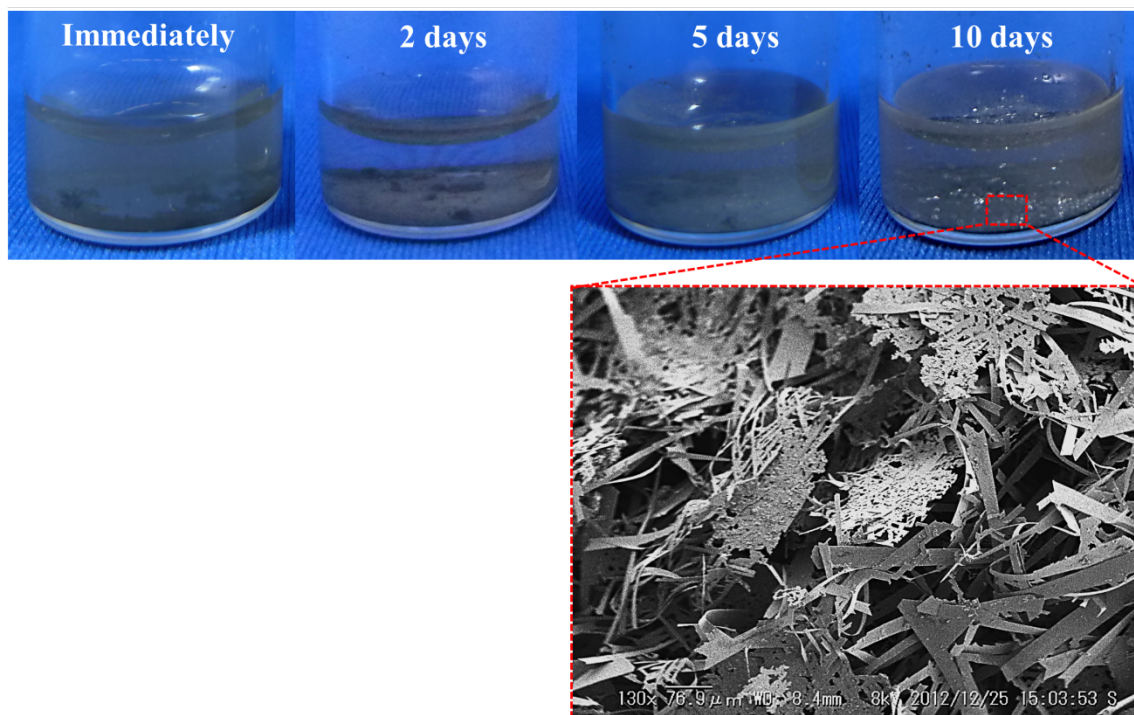


Figure S4: Digital images of typical Ag nanomaterial synthesized in PEG (10 g; 0.1 wt%) + AgNO₃ (500 µL; 1 M) + TEMED (250 µL) at room temperature at different times. The SEM image represents the luminescent Ag product.

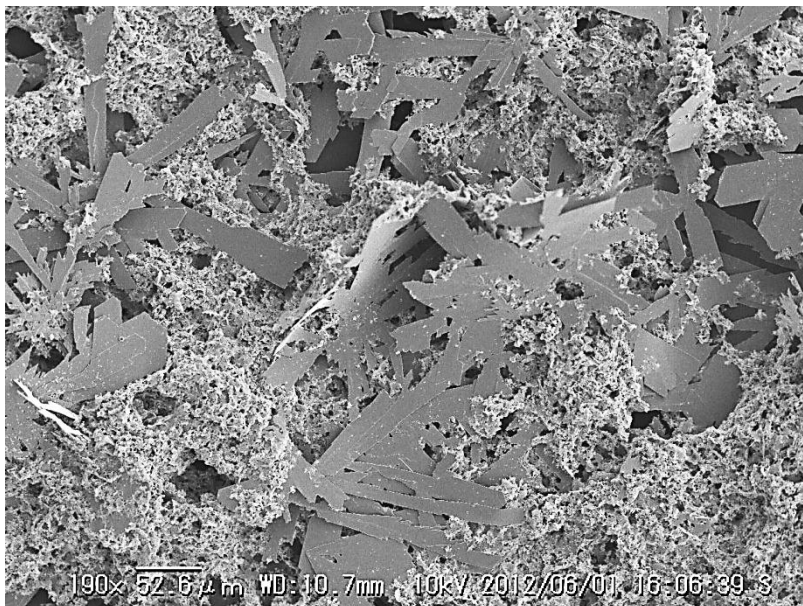


Figure S5: Typical SEM image of Ag nanomaterial synthesized in PEG ($M_w = 50,000$; 10 g; 1 wt%) + AgNO_3 (500 μL ; 1 M) + TEMED (250 μL) at room temperature.

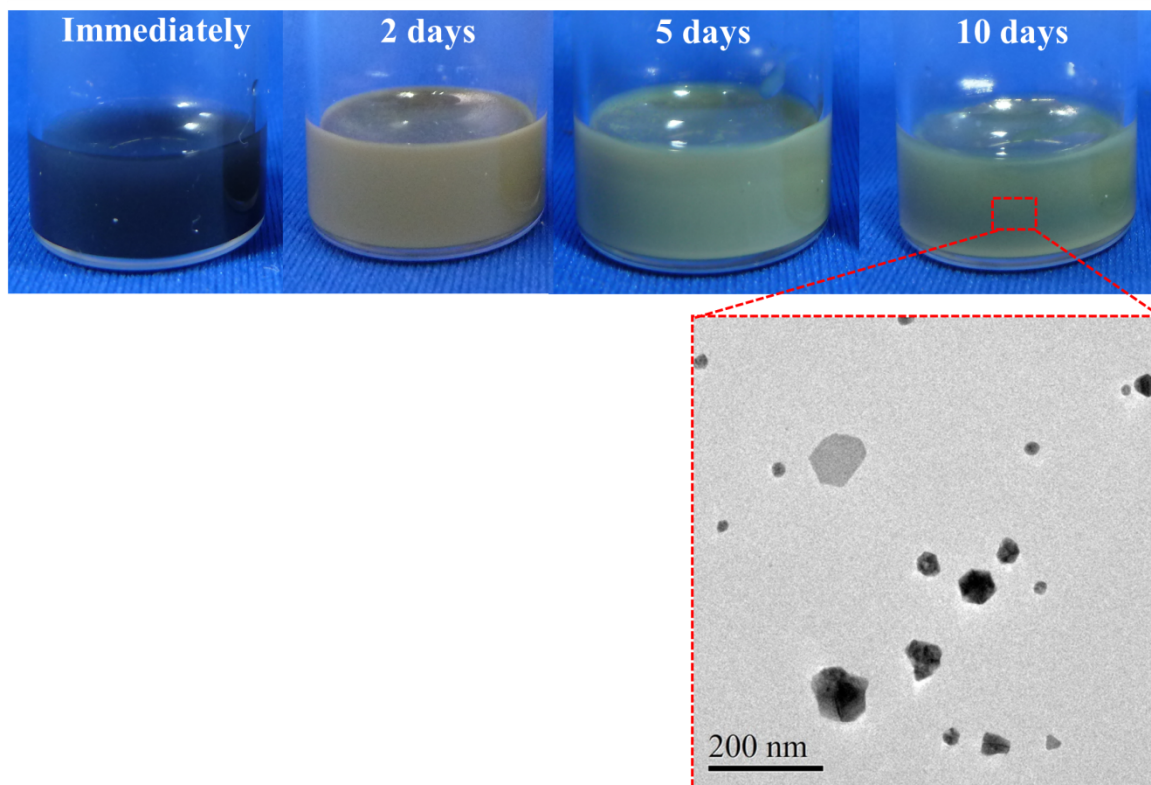


Figure S6: Digital images of typical Ag nanomaterial synthesized in poly(*N*-vinyl pyrrolidone) (10 g; 1 wt%) + AgNO₃ (500 μL; 1 M) + TEMED (250 μL) at 25 °C at different times. TEM image represents the Ag-product formation.

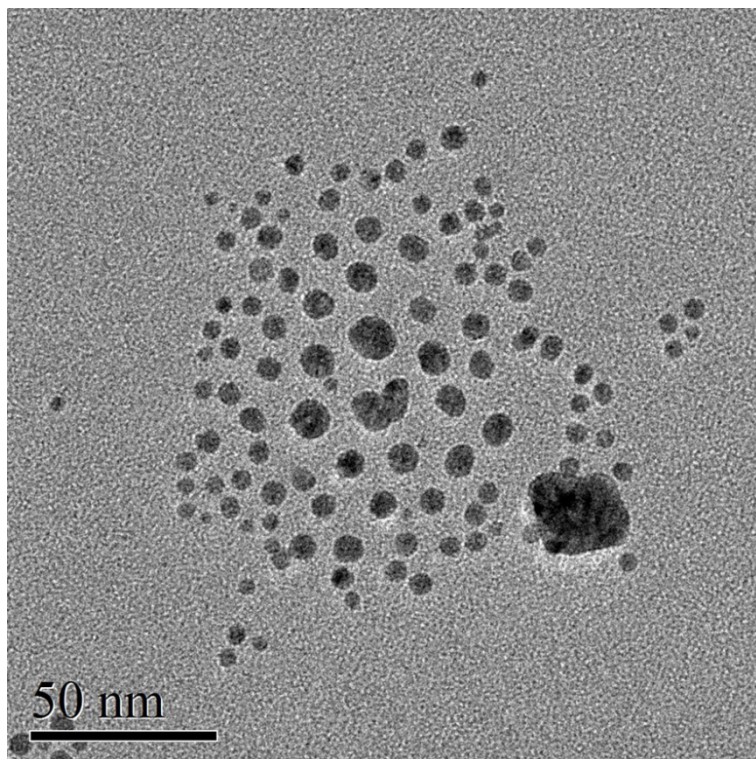


Figure S7: TEM image of the Ag nanomaterial synthesized in low molecular weight nonionic surfactant polyoxyethylene cholesteryl ether (ChEO_{15} : 10 g; 1 wt%) + AgNO_3 (500 μL 1 M) + TEMED (250 μL) at 25 $^{\circ}\text{C}$.