

Supporting Information

Size Controlled Deposition of Ag Nanoparticles on Alumina by the Assist of Photo-induced Chromic Reaction and Study of Their Catalysis

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Experimental Section

The synthesis of colloidal Ag NPs stabilized with 3-MPA: AgNPs were prepared using standard airless techniques on a Schlenk line. AgNO₃ (0.1 mol), 14 N aq.NH₄OH (26.0 ml), 3-MPA (8×10⁻³ mol) were dissolved in deionized water (15 ml) (solution A). NaBH₄ (0.02 mol), 14 N aq.NH₄OH (2.0 ml) were dissolved in deionized water (15 ml) (solution B). The above solution A and B were slowly added to deionized water (300 ml) over 30 min at room temperature. After 30 min, the mixture was subjected to ultra filtration, washed with water and stored in water.

The synthesis of Ag NP/Al₂O₃: A colloidal Ag aqueous solution (9.3 M, 10 ml) was mixed with ethanol solution of *trans*-2-hydroxychalcone (0.1 M, 10 ml) and the pH of the solution was adjusted to 5 with 0.1 N HCl. The obtained solution was irradiated by Xe lamp 500W; San-Ei Electric Co. Ltd., XEF-501S) for each time (0, 2, 4, 8 and 16 h), and quickly mixed with Al₂O₃ (0.5 g, JRC-ALO-8 supplied from the Japan Catalysis Society), and the slurry was further stirred for 0.5 h at room temperature. The precipitate was separated by filtration, thoroughly washed with deionized water and ethanol, and dried under vacuum. The obtained sample was calcined at 823 K for 10 h and treated by H₂ (20 mL·min⁻¹) at 473 K for 1 h. The amount of Ag deposition was determined to be 0.6 wt% by ICP analysis.

Characterization: X-ray diffraction patterns were recorded using a Rigaku Mini-flex using Cu K α radiation of wavelength 1.5418 Å. Elemental analysis was performed with EDX-720 (Shimadzu). The UV-vis spectra were recorded with Shimadzu UV-2200A photospectrometer. The zeta potential measurement was carried out with ELSZ-2 (Otsuka electronics). HCl and NH₄OH were used to adjust the solution pH. TEM micrographs were obtained with a Hitachi Hf-2000 FE-TEM equipped with a Kevex energy-dispersive X-ray detector operated at 200 kV. Ag K-edge XAFS spectra were recorded at room temperature in fluorescence mode at the beam line 01B1 station with an attached Si (311) monochromator at SPring-8, JASRI, Harima, Japan (prop. No. 2010A1540, 2010B1098).

A typical example for the reduction of 4-nitrophenol: Into a Pyrex reaction vessel were placed Ag/Al₂O₃ (0.02 g) and 46.4 mM of aqueous 4-nitrophenol solution (4 ml) and Ar gas was purged through the solution to remove the dissolved O₂. After the addition of 13.9 mM of aqueous NaBH₄ solution (20 ml), the resulting mixture was stirred at 300 K. Part of the mixture was taken out after every 10 min and centrifuged for the determination with UV photospectrometer. The peak at 400 nm corresponding to the 4-nitrophenol was monitored to determine the conversion of 4-nitrophenol.

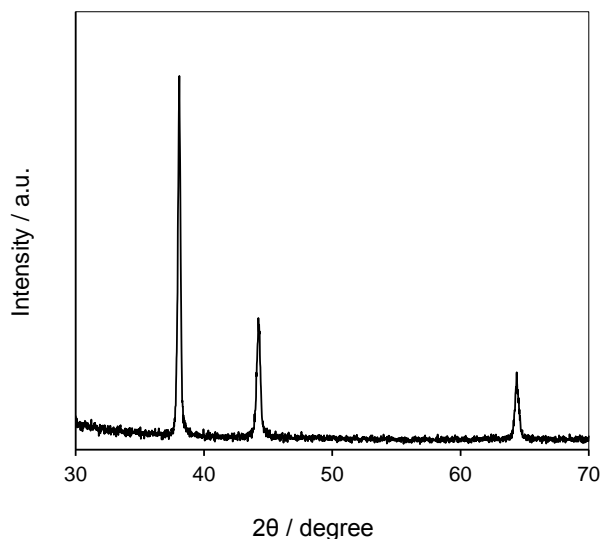


Figure S1 XRD pattern of colloidal Ag NPs with 3-MPA.

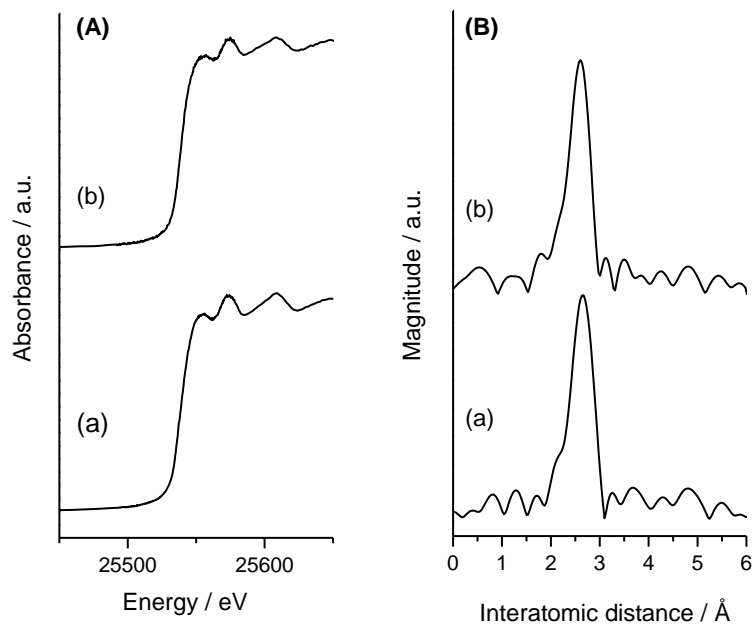


Figure S2(A) AgK-edge XANES spectra and (B) FT-EXAFS spectra for (a) Ag foil and (b) colloidal Ag NPs with 3-MPA.

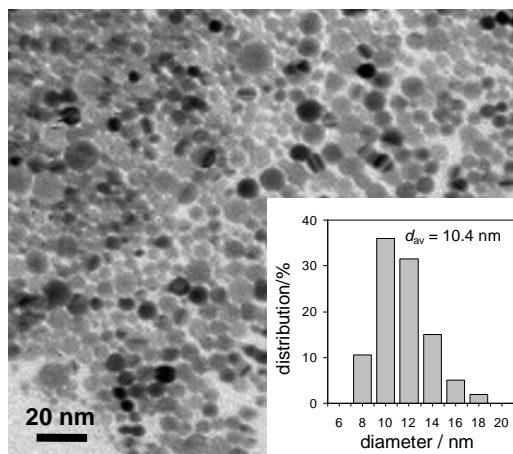


Fig.S3 TEM images and size distribution diagrams of colloidal Ag NP with 3-MPA.