† Electronic Supporting Information

Inkjet-Printed Highly Conductive Transparent Patterns with Water Based Ag-Doped Graphene†

Lihong Li, Yuzhen Guo, Xingye Zhang, Yanlin Song,*

Key Laboratory of Green Printing, Institute of Chemistry, Chinese Academy of Sciences, Beijing, China. Fax: 86 6252 9284; Tel:86 6252 9284; E-mail: ylsong@iccas.ac.cn

Experimental

In a typical synthesis of Ag nanoplates (Ag NTPs), 45 μl of $AgNO_3$ (0.1 M), 3 ml of TCD and 100μl of H_2O_2 (30 wt%) were dissolved in 50 ml of H_2O under vigorous stirring. 250 μl of ice-cold $NaBH_4$ was injected into the mixture, which turned yellow, black and then blue within a few minutes, and after 30 min the precursor sample was centrifuged and washed with H_2O twice. The collected sample was redispersed in 10 ml of H_2O. To this solution was added 1 ml of PVP (5 wt%) and 40μl of ascorbic acid (0.5 M), and then 0.6 ml of $AgNO_3$ slowly under stirring. After that, 300 μl of TCD was added subsequently, and then a mixed solution containing 60 μl of $AgNO_3$ (0.1 M), 900 μl of TCD was also added slowly (5μL/s), for lateral growth of the Ag nanoplates. The reaction was allowed to proceed for one additional hour. The sample was collected by centrifugation and vacuum rotary evaporation.

In a typical synthesis of Ag nanoparticles (Ag NPs), 100 μL of the aqueous solution of TCD (10wt %) and 25 μL of the aqueous solution of $AgNO_3$ (10wt %) were consecutively added to 2.5 mL of water under stirring at room temperature, and the colour of the mixture was from white to colorless. 50 μL of the aqueous solution of AC (0.10 mM) and KI (5 μM) was in sequence added into 47.5 mL of water at 80 ºC. Then, the aqueous solution was kept heating and the mixture solution of TCD and $AgNO_3$ was injected into it. The yellow reaction solution was kept at 100 °C for 1 h under stirring to warrant formation of uniform polyhedral Ag nanoparticles. The sample was washed by water and ethanol, and collected by centrifugation and vacuum rotary evaporation.

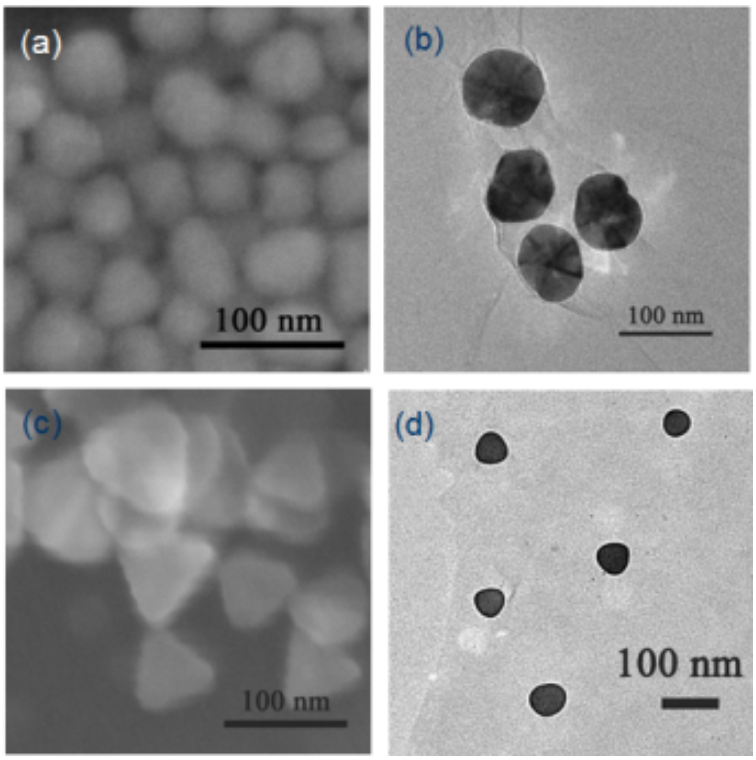

Fig. S1 The SEM images of as-synthesized (a)Ag NPs, (c)Ag NTPs, the TEM images of as-synthesized (b)Ag NPs-GO, (d) Ag NTPs-GO.

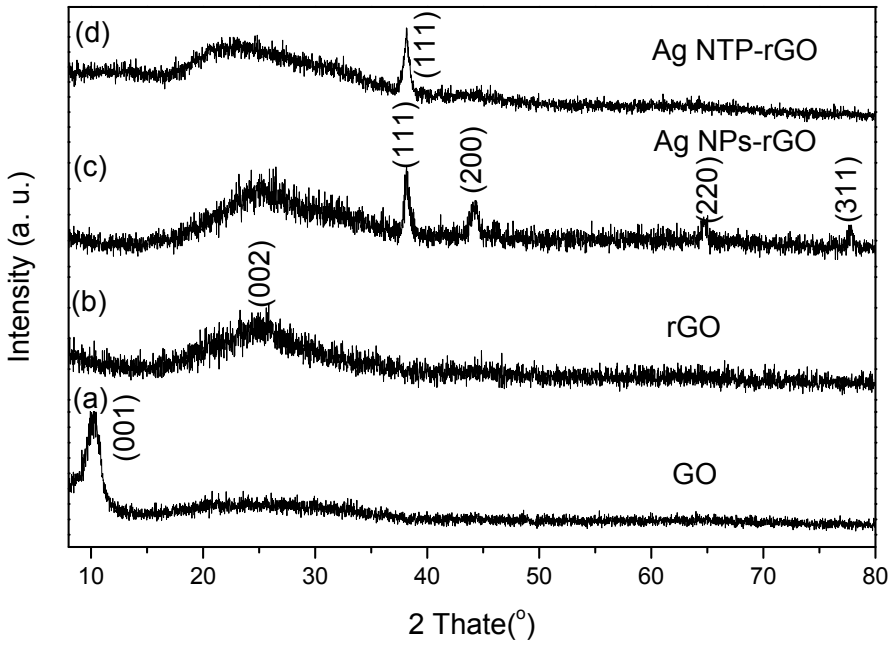

Fig. S2 The XRD spectra of as-synthesized (a) GO, (b) rGO, (c) Ag NPs-rGO, and (d) Ag NTPs-rGO.

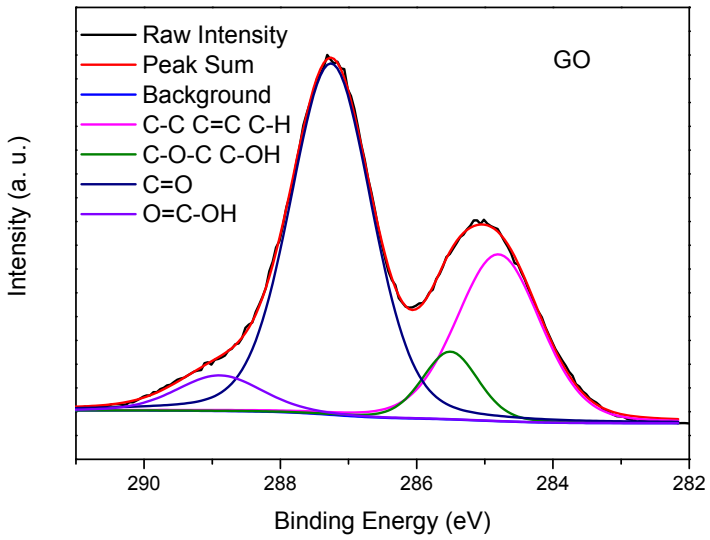

Fig. S3 The XPS spectrum of C1s peaks of as-synthesized GO.

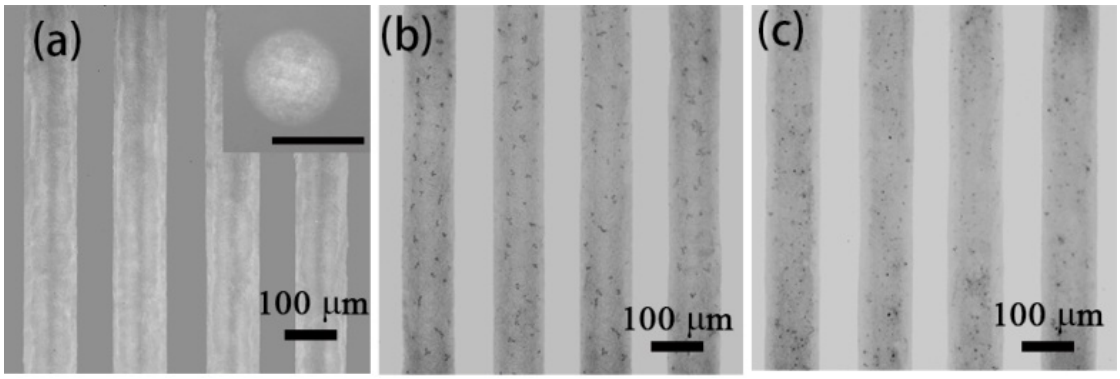

Fig. S4 Morphology of the inkjet-printed rGO-based patterns on glass substrates. Optical microscopy images of (a) printed lines and a drop (inset, scale bar corresponds to 40 μm) of rGO illustrate the uniformity of the printed features. (b) Printed lines of Ag NPs-rGO. (c) Printed lines of Ag NTPs-rGO.

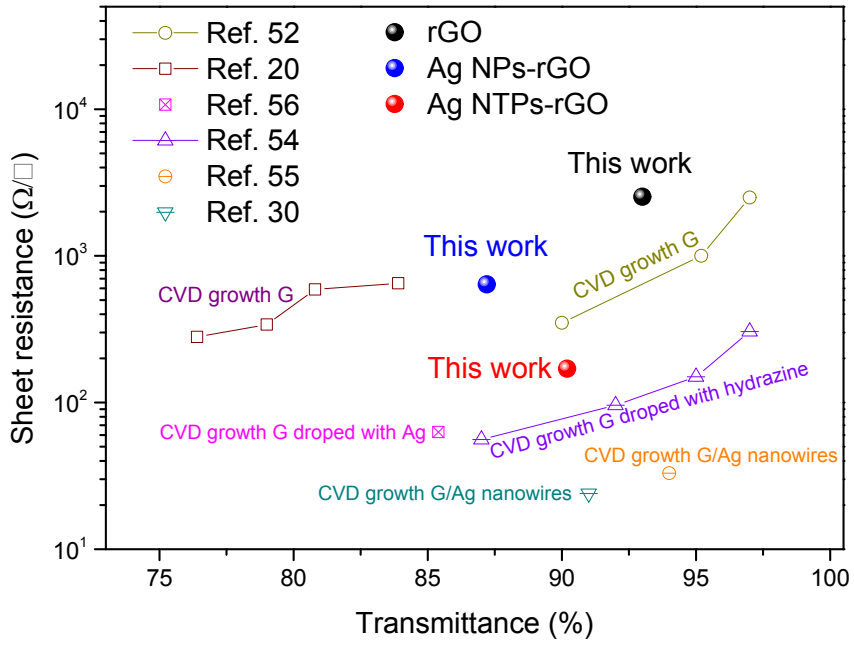

Fig. S5 Sheet resistance vs transmittance of inkjet-printed rGO-based patterns compared to reported transparent CVD-growth G-based results.

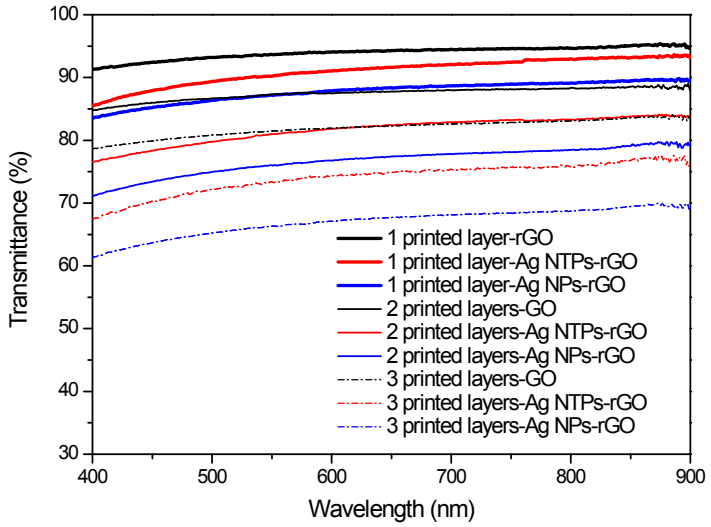

Fig. S6 The transmittance as a function of wavelength for the different inkjet-printed layers of rGO-based patterns.

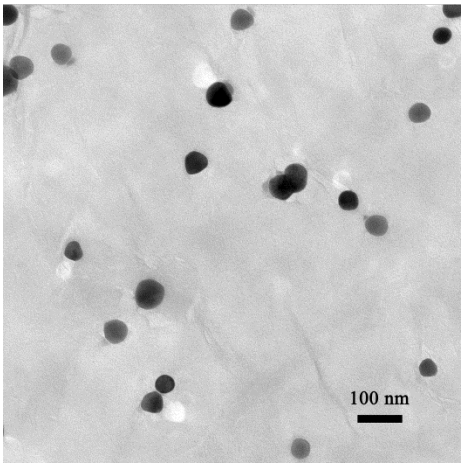

Fig. S7 The TEM images of as-prepared Ag NTPs-rGO.

Table S1. Analysis of C1s peak positions and the relative percentages of different C species with respect to (a)GO, (b)rGO, (c)Ag NPs-rGO, and (d) Ag NTPs-rGO.

	C-C C=C C-H	C-O	C=O	COOH
GO	284.8 (28.4%)	285.5 (7.6%)	287.2 (57.9%)	288.9 (6.1%)
rGO	284.8 (68.2%)	285.5 (14.5%)	287.2 (14%)	288.9 (3.3%)
Ag NPs-rGO	284.8 (70.6%)	285.6 (13%)	287.3 (13.2%)	289.2 (3.5%)
Ag NTPs-rGO	284.8 (85.4%)	285.8 (9.7%)	287.2 (3.1%)	289.2 (1.8%)