Supporting Information

Investigating the Mechanism of Catalytic Reduction of Silver Nitrate on the Surface of Barium Titanate at Room Temperature: Oxygen Vacancies Play a Key Role

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1. Details of Experimental procedures

Materials: The $BaTiO_3$ (100 nm) nanoparticles were obtained from Shandong Guoci Functional Materials Co. China with the trade name of GC-BT-01. Silver nitrate ($AgNO_3$) and Hydrogen Peroxide (30 wt%) were supplied by Guoyao Chemical Co. China. Ethylene glycol was achieved from Shanghai Lingfeng Chemical Co. China.

Preparing BT-H particles: 10 g BT was stirred under ultrasonic treatment in a 80 ml aqueous solution of H_2O_2 for 30 min and then refluxed at 105 ℃ for 6 hours. The obtained suspension was rinsed and centrifuged three times with deionized water and ethanol. The nanoparticles were dried in vacuum desiccator for 1d at room temperature.

Preparing BT-T particles: The BT-T particles were obtained through thermal treated at 350 ℃ in muffle furnace for 10 hours.

Preparing BT-Ag particles: $AgNO_3$ (0.2 g) was dissolved in 12 ml ethylene glycol solution under magnetic stirring. Then 0.2 g BT added into the solution and magnetic stirring for 2 hours at room temperature. The color changing progress was recorded with camera. Photographs were gathered every 10 min from 0 min to 120 min.

Characterization: Scanning electron microscope (FEI Nova NanoSEM450) and Transmission electron microscope (TEM, FEI Tecnai Spirit) were employed to observe the microscopic structure of BT-Ag hybrid particles. The surface chemistry of BT particles was characterized by FTIR (Vertex 70, Bruker) and XPS (PHI 1800, VLVAC-PHI).

2. Photographs of BT suspension

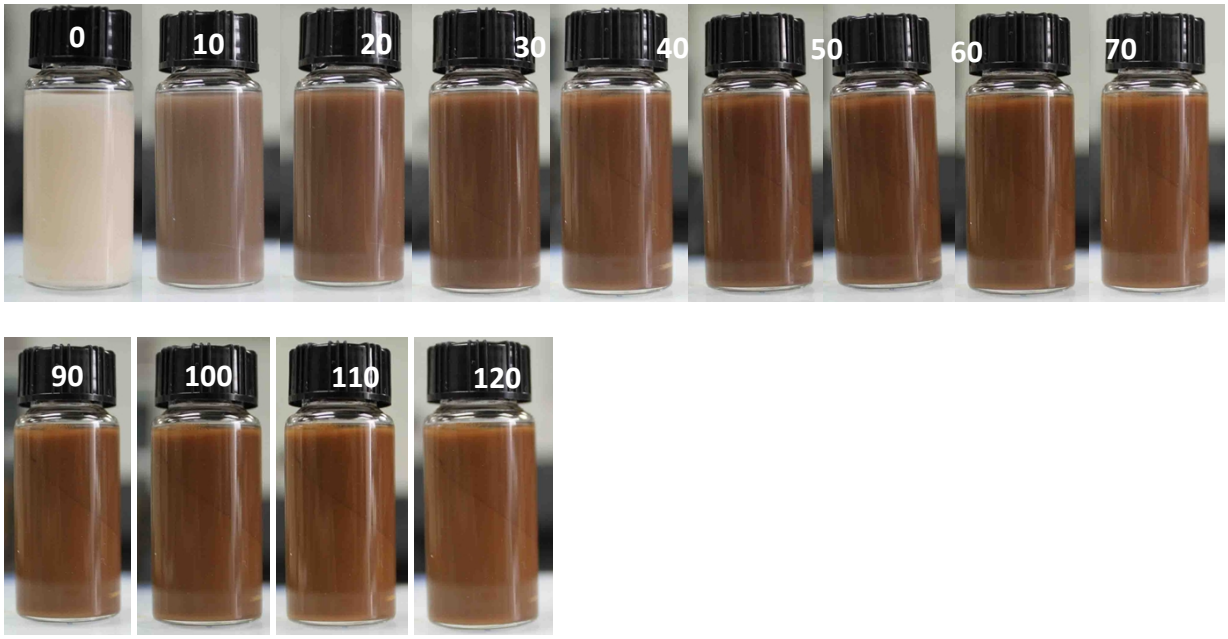


Figure S1 Photographs of BT-T/$AgNO_3$/EG suspension under magnetic stirring for 2 hours at room temperature. Photographs were gathered every 10 min from 0 min to 120 min.

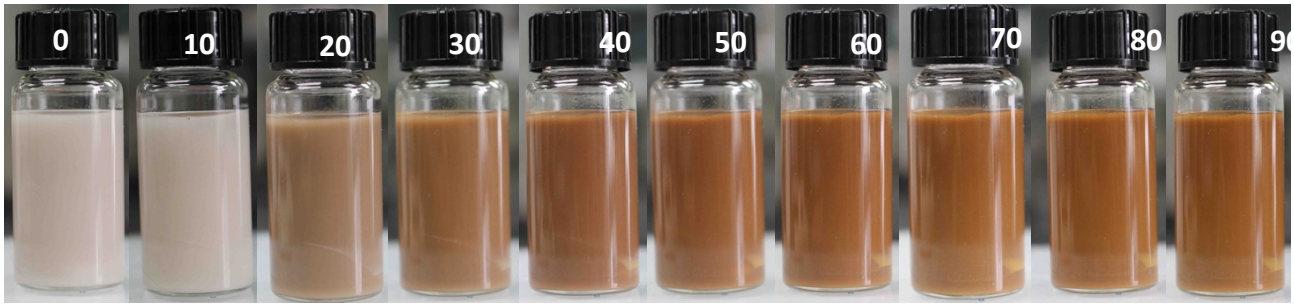


Figure S2 Photographs of BT-U/$AgNO_3$/EG suspension under magnetic stirring for 2 hours at room temperature. Photographs were gathered every 10 min from 0 min to 120 min.

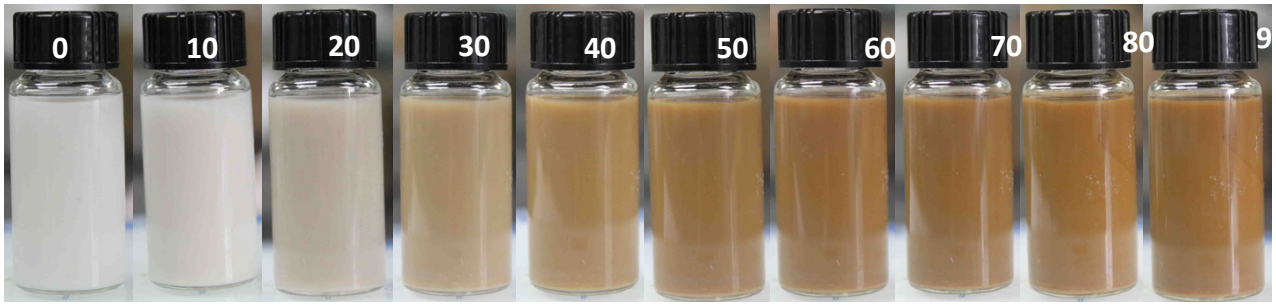
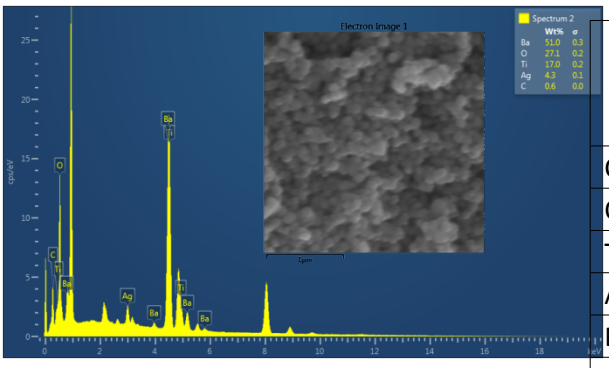


Figure S3 Photographs of BT-H/$AgNO_3$/EG suspension under magnetic stirring for 2 hours at room temperature. Photographs were gathered every 10 min from 0 min to 120 min.

3. EDS analyze of the resultant BT-Ag particles



Element	Apparent Concentration	Wt%	Atomic %
C	6.27	0.56	1.86
O	41.83	27.08	67.53
Ti	30.99	17.04	14.20
Ag	7.22	4.33	1.60
Ba	88.87	50.98	14.81
Total:		100.00	100.00

Figure S4 EDS analyze of BT (untreated)-Ag hybrid particles.

The EDS analyze of BT (untreated)-Ag hybrids shows that the content of silver in the hybrid was about 4.33 wt%. The results further indicated the small particles on BT surface was silver nanoparticles.

4. FTIR of the solution after synthesis

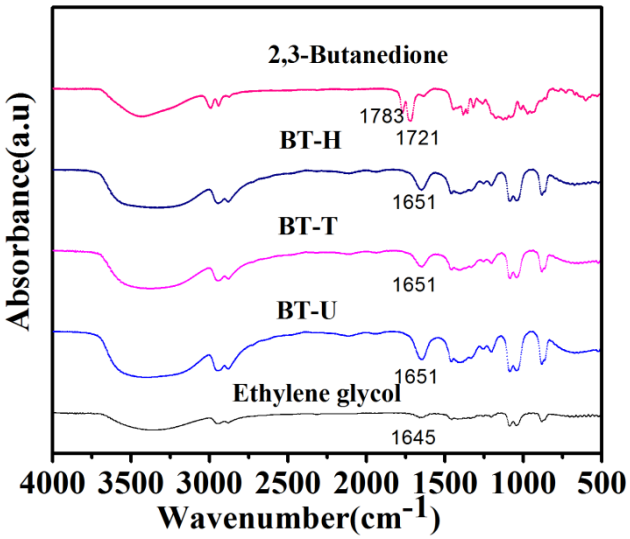


Figure.S5 FTIR spectra of the solution after synthesis.

The solution after synthesis was analyzed with FTIR. As illustrated by equations (1) (2) and scheme 1 in the manuscript, 2,3-Butanedione and water were produced after reaction. Thus, the FTIR was also carried out on 2,3-Butanedione for comparison. As shown in Figure R5 below, the absorption bands of 2,3-Butanedione at 1721 cm^{-1} was observed which correspond to the stretching vibration of –C=O. A small absorption band of EG at 1645 cm^{-1} corresponds to the absorbed water. The FTIR profiles of the solution after synthesis show absorption band at 1651 cm^{-1}.

According to the reaction process, the EG acted as reducing agent and was consumed by a very small amount. 0.21677 mol EG was added in the reaction process and the consumed amount was 0.00118 mol. The content of the produced 2,3-Butanedione and water was 0.00118 mol, respectively. Therefore, the concentration of 2,3-Butanedione is very small. And, EG was polar solvent. So the absorption band at 1651 cm^{-1} should be attribute to the overlap of the –C=O and water.