Supplementary Information

Facile Synthesis of Concave Gold Nanoplates in Hexagonal Liquid Crystal Made of SDS/Water System

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Experiment of interrupting the growth of gold plates:

Fig. S1 TEM images (a-e) corresponding to products formed at room temperature in the hexagonal LLC of SDS (45 wt%)/HAuCl\textsubscript{4} (aq, 0.03M)/glycine (1.5 wt%) at 8, 15, 60, 600 min and 30 days of reaction, respectively.

Fig. S1(a) shows that the nanoplates with the side length of 150-350 nm are the main products at 8 min. After 15 min, most of products are the plates similar to Fig. S1(a). Noticeably, some bigger plates with the side length of about 500 nm are obtained and seem to be concaved at the center (Fig. S1 b). Such plates have relative obvious concave centers and their quantity increases when the reaction time is prolonged from 1 h to 10 h, with the quantity of smaller plates (the side length less than 300 nm)
decreasing dramatically (indicated by circles in Fig. S1 c and d). And when the reaction time extends to 3 days, concave plates are the main products and their edge sizes are about 1.3 μm. At 30 days, the concave centers of gold plates are expanded in area with incensement of their edge length size, indicating the growth of plates. The variation of the size and the quantity of smaller plates and larger plates verifies that the growth and oxidative etching of the plates occur simultaneously. Additionally, the AFM image shows the edge of plate (donated by the arrows) is not flat but etched. According to the literature (T. Soejima and N. Kimizuka, J. Am. Chem. Soc., 2009, 131, 14407.), oxidative etching and dissolution would occur preferentially at edges of high surface energy. At end of the reaction, the growth of plates almost stops but the etching process still happens, so the edge surface of gold plates is also etched evidently (indicated by the arrows of AFM images shown above).

**Experiment of electrochemical property:**
A CHI 660A electrochemical workstation with a conventional three-electrode cell is used to perform electrochemical measurements. A KCl-saturated calomel electrode (SCE), a platinum electrode and a glassy carbon electrode with a diameter of 4 mm is used as the reference electrode, the auxiliary electrode and the working electrode, respectively. For the preparation of concave nanoplate-modified GC electrode and gold nanoplate-modified electrode, the concave gold nanoplates and common gold nanoplates are dispersed in ethanol to obtain a uniform suspension of about 3 mg/mL by sonication. Glassy carbon electrodes are first polished with 0.05 μm alumina slurry and then washed ultrasonically in secondary water for a few minutes. The glassy carbon electrodes are coated by casting 6 μL of the above gold suspension and dried naturally in the air. Finally, 2 μL of 5 wt % Nafion alcohol solution is cast on the surface of the sample and dried naturally in the air. The surface area of concave nanoplate-modified glassy carbon electrode and gold nanoplate-modified glassy carbon electrode is calculated to be 0.026 cm² and 0.015 cm², respectively, from the charge consumed during the reduction of surface oxides using the reported valve of 400 μC/cm² for a clean Au electrode.