

## Electronic Supplementary Information (ESI)

### 1 Experiment section

#### 1.1 Chemical materials

Polyethylenimine(PEI)(50% water solution,70000M.W., ShangHai Aladdin industrial corporation). Deionized water was made from OKP equipment (Shanghai Lakecore company).  $\text{NH}_4[\text{NbO}(\text{C}_2\text{O}_4)_2(\text{H}_2\text{O})_2]\cdot\text{nH}_2\text{O}$  purchased from Qiandao Ruike chemical Company.  $\text{HNO}_3$ (65%wt, ShangHai LingFeng).  $\text{NH}_3\cdot\text{H}_2\text{O}$ (17%wt, ShangHai LingFeng). DMSO(dimethyl sulfoxide, Shanghai Lingfeng, AR>99%). D-(+)-Xylose(98%, Shanghai Aladdin industrial corporation)

$\text{NH}_4[\text{NbO}(\text{C}_2\text{O}_4)_2(\text{H}_2\text{O})_2]\cdot\text{nH}_2\text{O}$  was purified before use, 30g  $\text{NH}_4[\text{NbO}(\text{C}_2\text{O}_4)_2(\text{H}_2\text{O})_2]\cdot\text{nH}_2\text{O}$  was dissolved in 100ml deionized water heat to 80°C for 1h, and filtered while hot, the solution cooled down to the room temperature, collecting the white powder. Then, the purified powder prepared to a saturated solution using deionized water (approximately 2g per10ml).

#### 1.2 Synthesis process

The synthesis of  $\text{Nb}_2\text{O}_5$  nanowires were carried out as follows: PEI 10g was dissolved in 10ml DI water. Ammonium niobium oxalate saturated solution (ANOSS) 20ml was added into above solution.  $\text{HNO}_3$  was used to tuned pH value of the solution to 1-2(High acidity), 4-5(Medium acidity), 6-7(Low acidity) respectively. The solution was poured into the Teflon lined autoclaves, which was hydrothermal treatment at 180°C for 72h. Then a yellow or black gel obtained, washed off the most PEI in hot water at 80°C, then centrifuged 7500r/min 3min, cycle above washing process several times, dried the gel in vacuum oven under the temperature 30°C for 24h, a white powder can be obtained. Which was named as NN-180-H, NN-180-M, NN-180-L for the sample synthesized at high acidic, medium acidic and low acidic conditions, respectively. In order to remove the remaining PEI in the as-prepared sample, NN-180-H, NN-180-M and NN-180-L was heat treated at 500°C in air for 6h, and the white powder obtained was denoted as NN-500-H, NN-500-M and NN-500-L, respectively.

The synthesis of  $\text{Nb}_2\text{O}_5$  worm-like material is similar to that of nanowires except that the pH value was tuned to 9-10 by  $\text{NH}_3\cdot\text{H}_2\text{O}$ . The white powder we got was named as NW-180. After heat treatment at 500°C in air for 6h, the sample produced was denoted as NW-500.

#### 1.3 Characterization

The crystallographic information on the obtained  $\text{Nb}_2\text{O}_5$  nanocrystals was established by X-ray diffraction (XRD, using nickel-filtered Cu K $\alpha$  radiation). The morphology of  $\text{Nb}_2\text{O}_5$  nanocrystals was examined using transmission electronic microscope (TEM, JEM-2100). BET specific surface area determined using micromeritics Gemini instrument (type ASAP2010C). HPLC (Agilent 1200, ion-exchange column, C18 column 4.6×150 mm) determine the content of furfural and xylose.

**2 photographs of Nb<sub>2</sub>O<sub>5</sub> gels containing PEI**

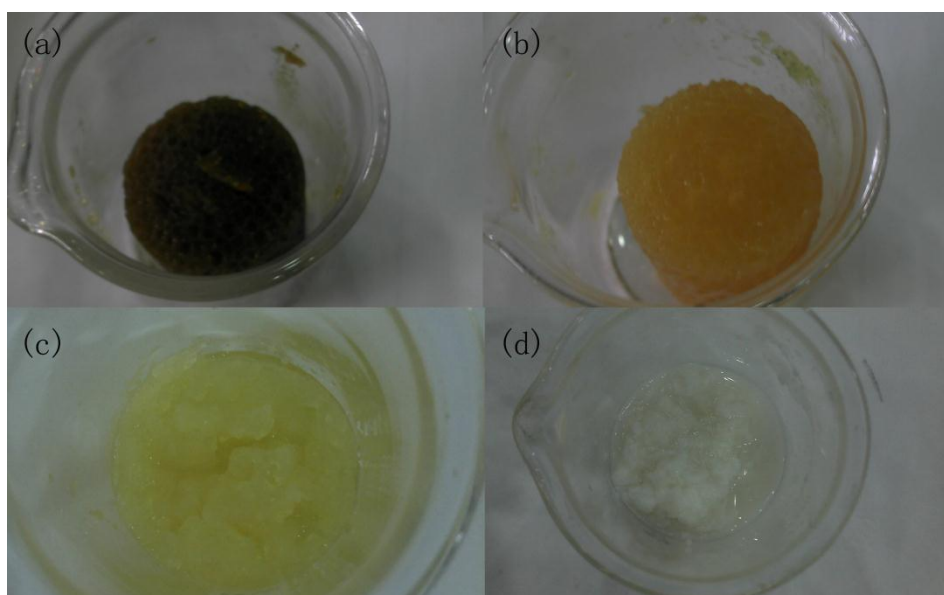


Fig. 1 Nb<sub>2</sub>O<sub>5</sub> nanomaterial gel containing PEI prepared under different pH value (a) high acidic, (b) medium acidic, (c) low acidic, (d) alkaline condition