Electronic Supplementary Information (ESI)

1 Experiment section

1.1 Chemical materials

Polyethylenimine (PEI) (50% water solution, 70000 M.W., ShangHai Aladdin industrial corporation). Deionized water was made from OKP equipment (Shanhai Lakecore company). NH₄[NbO(C₂O₄)₂(H₂O)₂]·nH₂O purchased from Qiandao Ruike chemical Company. HNO₃ (65% wt, ShangHai LingFeng). NH₃·H₂O (17% wt, ShangHai LingFeng). DMSO (dimethyl sulfoxide, Shanghai Lingfeng, AR>99%). D- (+)-Xylose (98%, Shanghai Aladdin industrial corporation)

NH₄[NbO(C₂O₄)₂(H₂O)₂]·nH₂O was purified before use, 30g NH₄[NbO(C₂O₄)₂(H₂O)₂]·nH₂O was dissolved in 100ml deionized water heat to 80℃ 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 per 10ml).

1.2 Synthesis process

The synthesis of Nb₂O₅ 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. HNO₃ 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℃ for 72h. Then a yellow or black gel obtained, washed off the most PEI in hot water at 80℃, then centrifuged 7500r/min 3min, cycle above washing process several times, dried the gel in vacuum oven under the temperature 30℃ 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℃ 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 Nb₂O₅ worm-like material is similar to that of nanowires except that the pH value was tuned to 9-10 by NH₃·H₂O. The white powder we got was named as NW-180. After heat treatment at 500℃ in air for 6h, the sample produced was denoted as NW-500.

1.3 Characterization

The crystallographic information on the obtained Nb₂O₅ nanocrystals was established by X-ray diffraction (XRD, using nickel-filtered Cu Kα radiation). The morphology of Nb₂O₅ 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$_2$O$_5$ gels containing PEI

Fig. 1 Nb$_2$O$_5$ nanomaterial gel containing PEI prepared under different pH value (a) high acidic, (b) medium acidic, (c) low acidic, (d) alkaline condition