# Supporting Information for

# Silicone-oil-assisted synthesis of high-quality sodium niobate nanowires

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## Experimental Procedure

### Chemicals

Niobium oxide (Alfa Aesar, 99.9985%), sodium hydroxide (Alfa Aesar, 98%), silicone oil (Dow Corning, viscosity: 100 cs), and anhydrous ethanol (99.7%) were purchased and used without further purification.

### Synthesis of $Na_2Nb_2O_6 \cdot H_2O$ Nanowires

Nanowires of $Na_2Nb_2O_6 \cdot H_2O$ were synthesized by a silicone-oil-assisted hydrothermal method. In a typical process, 0.75 mmol $Nb_2O_5$ (0.2 g) was added into the NaOH solution (30 ml, 10 M), followed by the addition of silicone oil under continuous stirring. After magnetic stirring for 2 hours, the obtained transparent solution was transferred into a 50 mL Teflon-lined stainless steel autoclave to undergo hydrothermal reaction at 150 °C for 5 hours in an oil bath under magnetic stirring. After cooled down to room temperature, the obtained white precipitate was washed with deionized water and ethanol for several times, and dried at 80 °C. To investigate the effect of silicone oil on the synthesis of $Na_2Nb_2O_6 \cdot H_2O$ nanowires, different amount of silicone oil (0 ml, 0.1 ml, 0.25 ml, 0.5 ml, 1 ml, 2 ml) were used in this process.

### Synthesis of $Na_2Nb_2O_6 \cdot H_2O$ Nanowires

$NaNbO_3$ nanowires were obtained through phase transformation of $Na_2Nb_2O_6 \cdot H_2O$ by annealing treatment at 500 °C for 4 hours.

### Characterization

The crystal structure and phase composition were characterized by X-ray diffraction (XRD) (Rint-2000V/PC diffractometer, Rigaku, Japan) with Cu/Kα radiation (λ = 1.5406 Å). The microstructure of the products was imaged using scanning electron microscopy (SEM, S4800, Zeiss, Japan, 5 KV) and transmission electron microscopy (TEM, Tecnai G2 F30, FEI, USA, 300 KV). Dehydration process and temperature of phase transition of products were analyzed by Thermogravimetric analysis and differential

scanning calorimetry (TGA/DSC, STA 449 F3, $N_2$ flow ~ 10 ml·min$^{-1}$, heating rate ~ 10 K·min$^{-1}$). Fourier Transform infrared spectroscopy (FTIR) was conducted with Thermo Scientific Nicolet iS 50.

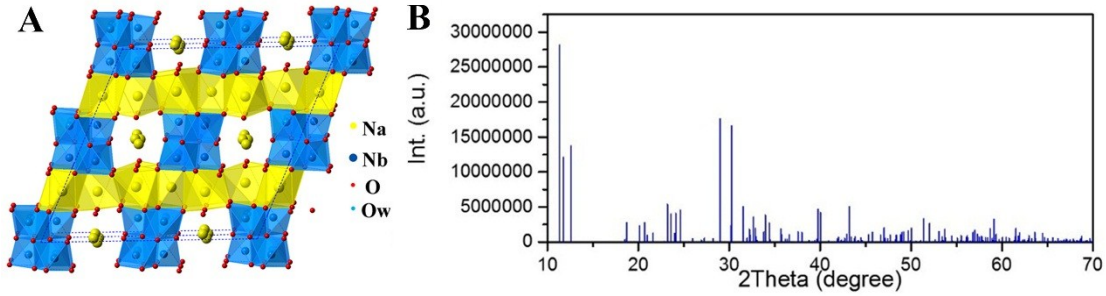


**Figure S1.** (A) Crystal structure of $Na_2Nb_2O_6 \cdot H_2O$ nanowire, and the yellow, blue, red and cyan spheres represent Na, Nb, O and Ow atoms, respectively (Ow represents O of $H_2O$ molecules); (B) the according XRD pattern obtained by using crystals impact diamond 3[1].

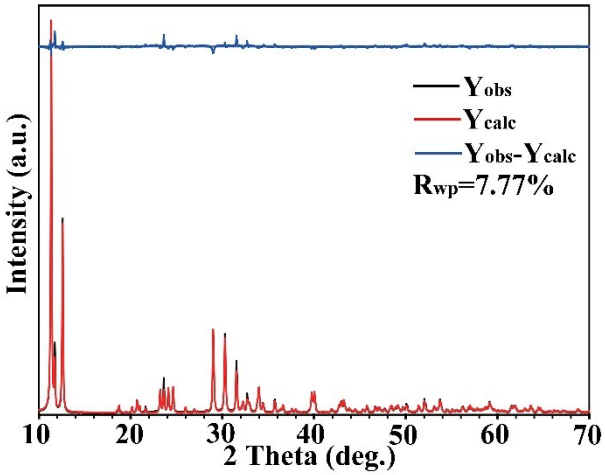


**Figure S2.** The observed (black), calculated (red) and difference (blue) profile of $Na_2Nb_2O_6 \cdot H_2O$ nanowires.

**Table S1.** Refined cell parameters of as-prepared $Na_2Nb_2O_6 \cdot H_2O$ phase (Space Group *C2/c*) in comparison with standard data.

| Cell parameters | a (Å) | b(Å) | c(Å) | α(°) | β(°) | γ(°) |
|---|---|---|---|---|---|---|
| **Refined** | 17.0503 | 5.0272 | 16.4850 | 90.0 | 113.9394 | 90.0 |
| **Standard*** | 17.0511 | 5.0293 | 16.4921 | 90.0 | 113.9420 | 90.0 |

*: Obtained from Crystallography Open Database (COD).

**Table S2.** Atomic Coordinates of as-prepared $Na_2Nb_2O_6 \cdot H_2O$ phase.

| atom | x | y | z |
|---|---|---|---|
| **Na1** | 0.335 | -0.366 | 0.734 |
| **Na2** | 0.5 | 0.14 | 0.75 |
| **Na3** | 0.263 | 0.288 | 0.012 |
| **Nb1** | 0.405 | 0.046 | 0.906 |
| **Nb2** | 0.533 | 0.549 | 0.915 |
| **O1** | 0.461 | -0.254 | -0.004 |
| **O2** | 0.477 | -0.148 | 0.849 |
| **O3** | 0.42 | 0.359 | 0.85 |
| **O4** | 0.378 | 0.249 | 0.993 |
| **O5** | 0.6 | 0.418 | 0.861 |
| **O6** | 0.302 | -0.094 | 0.837 |
| **O7** | 0.199 | 0.505 | 0.869 |

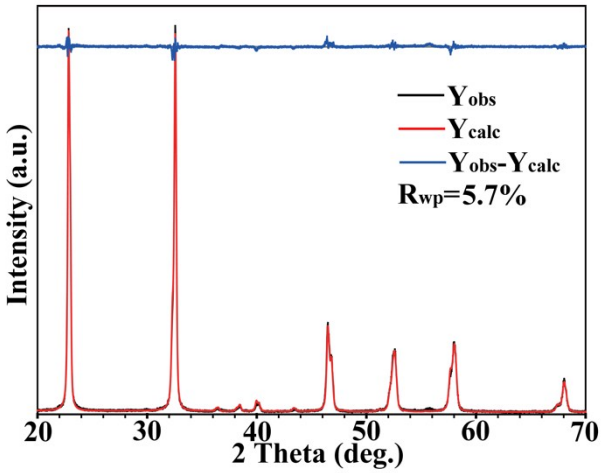


**Figure S3.** The observed (black), calculated (red) and difference (blue) profile of $NaNbO_3$ nanowires.

**Table S3.** The refined cell parameters of as-prepared $NaNbO_3$ phase (Space group *P21ma*) in comparison with standard data.

| Cell parameters | a(Å) | b(Å) | c(Å) | α(°) | β(°) | γ(°) |
|---|---|---|---|---|---|---|
| **Refined** | 5.5588 | 7.776 | 5.5105 | 90.0 | 90.0 | 90.0 |
| **Standard*** | 5.569 | 7.79 | 5.518 | 90.0 | 90.0 | 90.0 |

*: Obtained from COD.

**Table S4.** Atomic Coordinates of as-prepared $NaNbO_3$ phase.

| atom | x | y | z |
|---|---|---|---|
| **Na1** | 0.252 | 0.0 | 0.739 |
| **Na2** | 0.28 | 0.5 | 0.742 |
| **Nb1** | 0.27 | 0.251 | 0.244 |
| **O1** | 0.24 | 0.0 | -0.31 |
| **O2** | 0.221 | 0.5 | 0.19 |
| **O3** | 0.026 | 0.28 | 0.539 |
| **O4** | -0.046 | 0.021 | 0.038 |

**Reference:**

1. H. Xu, M. Nyman, T. M. Nenoff and A. Navrotsky, *Chemistry of materials*, 2004, **16**, 2034-2040.