

## Supporting Information

### Growth mechanism study via in situ epitaxial growth of high-oriented ZnO nanowires

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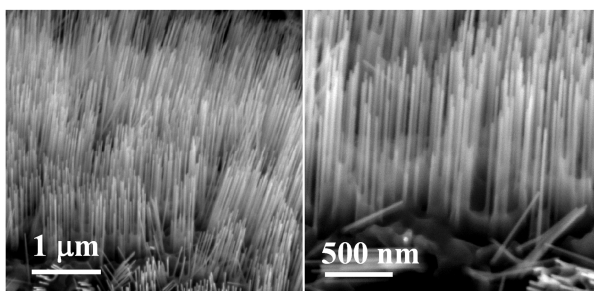
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#### 1. Orientation of nanowires:

The orientation of nanowires grown on annealed zinc film was better than nanowires grown on the unannealed zinc film. We can observe the nanowires with high orientation (see Figure S1) in some area.

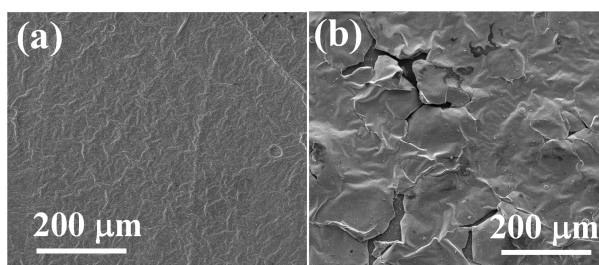


**Figure S1.** The nanowires with better orientation grown on pre-annealed zinc film.

#### 2. Cracks on pre-annealed zinc films:

Figure S2 shows that the unannealed zinc film was more flat compared with annealed zinc film after growth. We observed only wrinkles distributed in the unannealed film. However, the annealed zinc film showed greater density of cracks after growth. We

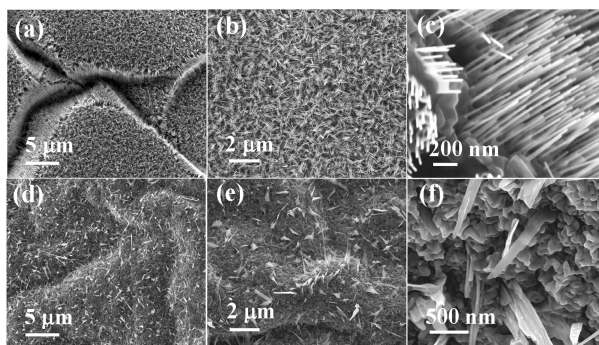
found such arched areas and many cracks in pre-annealed zinc film, which were not observed on unannealed zinc film. The cracks provided the channels for zinc vapor evaporation from zinc film leading to larger zinc concentration during growth.



**Figure S2.** Typical SEM morphology of unannealed and annealed zinc film after growth, respectively.

### 3. Comparision on zinc concentration:

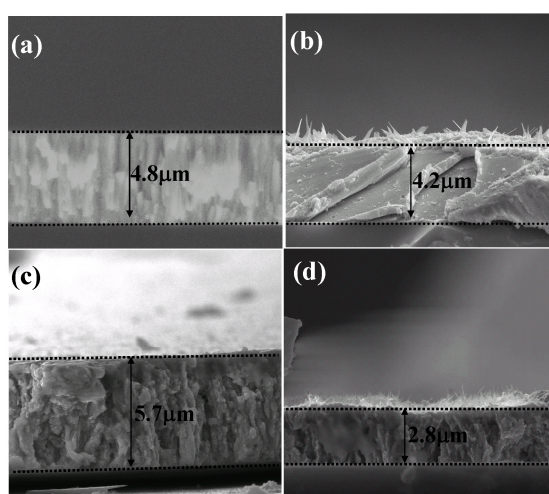
The morphology of ZnO nanowires grown on annealed and unannealed zinc film were shown in Figure S3(a~c) and Figure S3(d~e), respectively. The density of nanowires grown on the pre-annealed zinc film was lager than that of the nanowires grown on unannealed zinc film. The magnified SEM images in (c) and (d) demonstrated that clearly. The higher growth density of nanowires may be one evidence of higher zinc concentration produced by using pre-annealed zinc film.



**Figure S3.** The density contrast of nanowires grown on pre-annealed zinc film and unannealed zinc film, respectively. (a-c) The morphology of nanowires grown on pre-annealed zinc film. (d-f) The morphology of nanowires grown on unannealed zinc film.

#### 4. Comparision on zinc concentration:

Figure S4 show the cross-section images of zinc film before and after growth, respectively. We can see that the thickness of unannealed zinc film have a little change ( $\sim 0.6 \mu\text{m}$ : from  $4.8 \mu\text{m}$  to  $4.2 \mu\text{m}$ ) after growth. However, the thickness of pre-annealed zinc film decreased  $2.9 \mu\text{m}$  from  $5.7 \mu\text{m}$  to  $2.8 \mu\text{m}$  after growth. It suggested that the pre-annealed zinc film evaporated more seriously than unannealed zinc film during the growth. The reduction in zinc film thickness suggested that more zinc evaporated from pre-annealed zinc film during growth process, producing higher Zn concentration for reaction.



**Figure S4.** (a, b) Cross-section SEM images of unannealed zinc film before and after

growth, respectively. (c, d) Cross-section SEM images of pre-annealed zinc film before and after growth, respectively.