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Supplementary Materials

Evolution of Zinc Oxide Nanostructures through Kinetics Control

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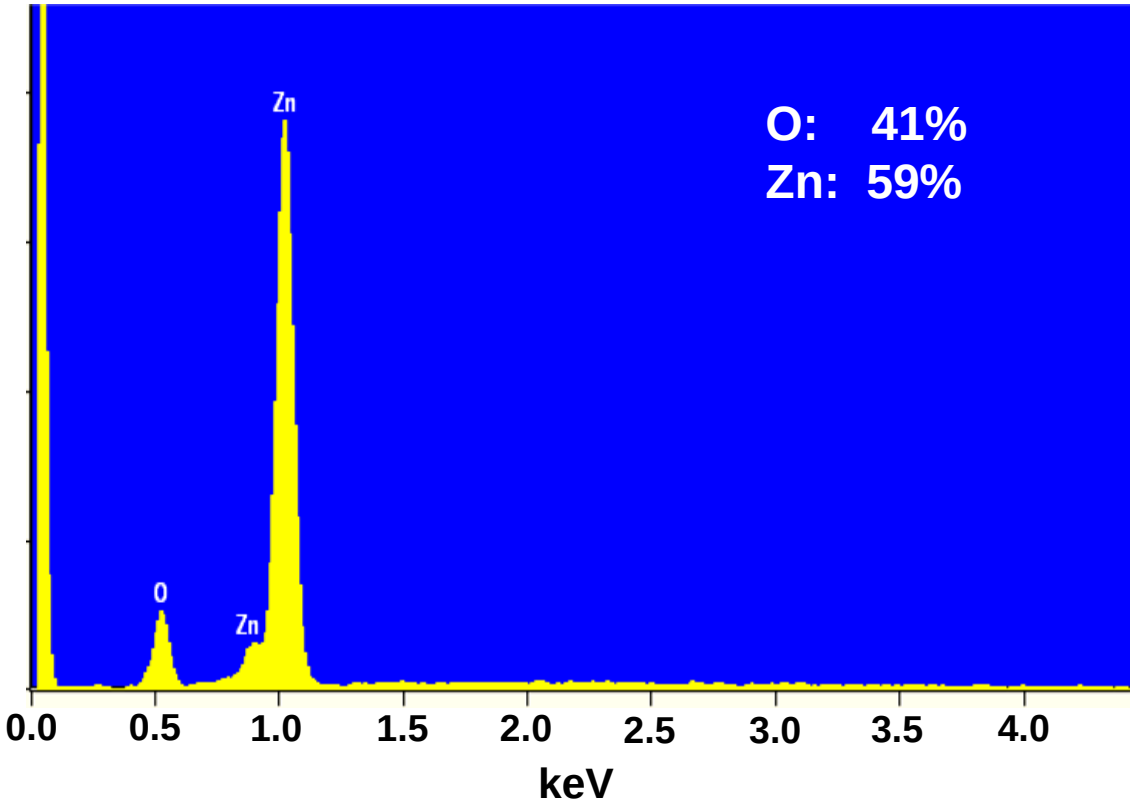

Figure S1. EDS spectrum of ZnO nanoflowers.

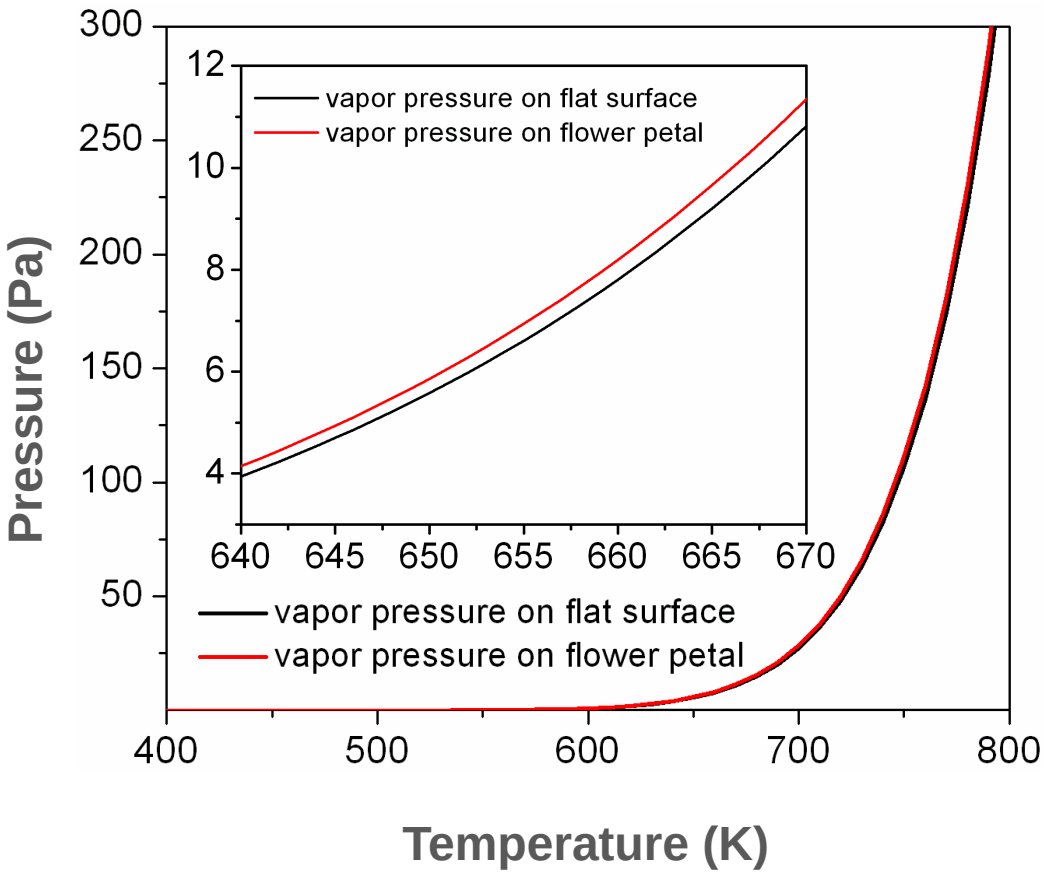

Figure S2. Vapor pressure of Zn over flat surface and spherical petal tip. The vapor pressure of Zn on flat surface is derived from ref. [S1], while the vapor pressure over petal tip can be computed by following equation, [S2]

$$\ln(p_r / p_\infty) = \pm 2\sigma v / rkT$$

Where p_r and p_∞ are the vapor pressure of curved surface and flat surface, respectively. r is the radius of the surface, σ is the surface tension and v is the volume of single molecule.

References:

S1. Alcock, C.B., Itkin, V.P. & Horrigan, M.K. Vapor-Pressure Equations for the Metallic Elements - 298-2500-K. Canadian Metallurgical Quarterly 23, 309-313 (1984).

S2. Hammel, E.F., The Vapor Pressure of Curved Surfaces. Journal of Chemical Education 35, 28-29 (1958).

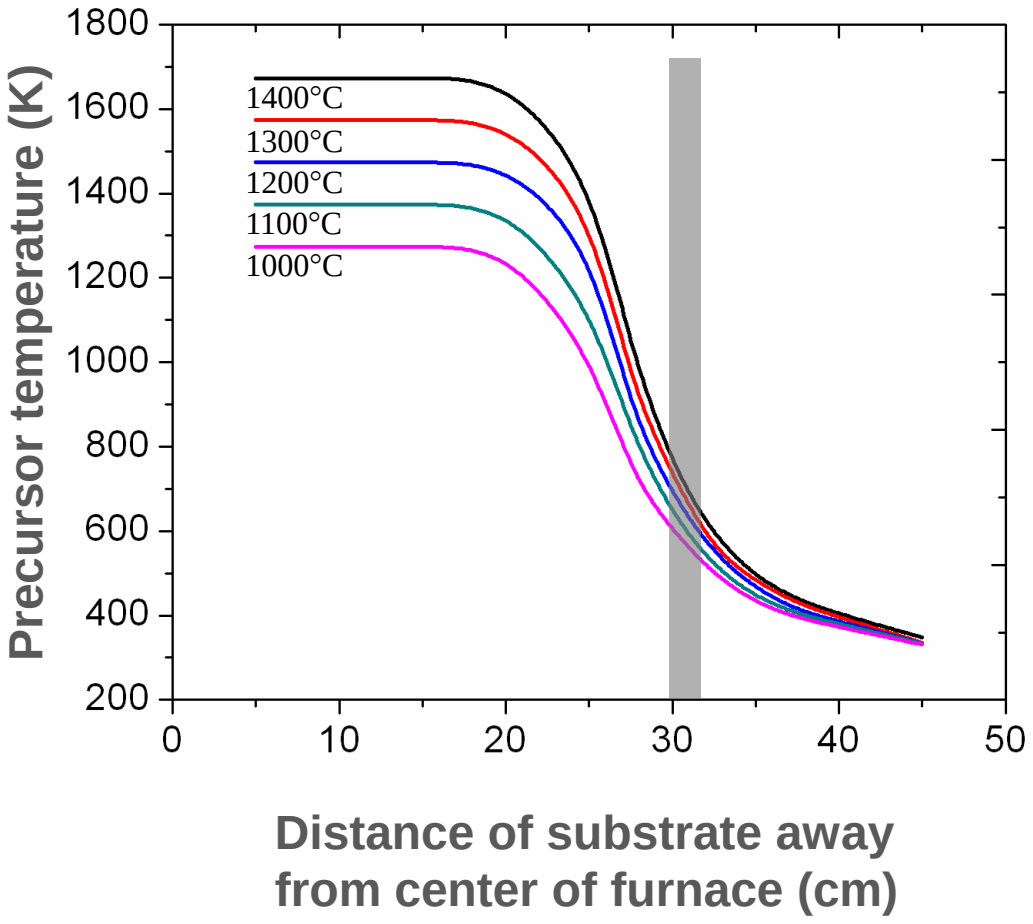

Figure S3. Temperature profile of furnace at different precursor temperatures: 1000 °C, 1100 °C, 1200 °C, 1300 °C, and 1400 °C. The region where nanoflowers form is highlighted by the grey rectangle.

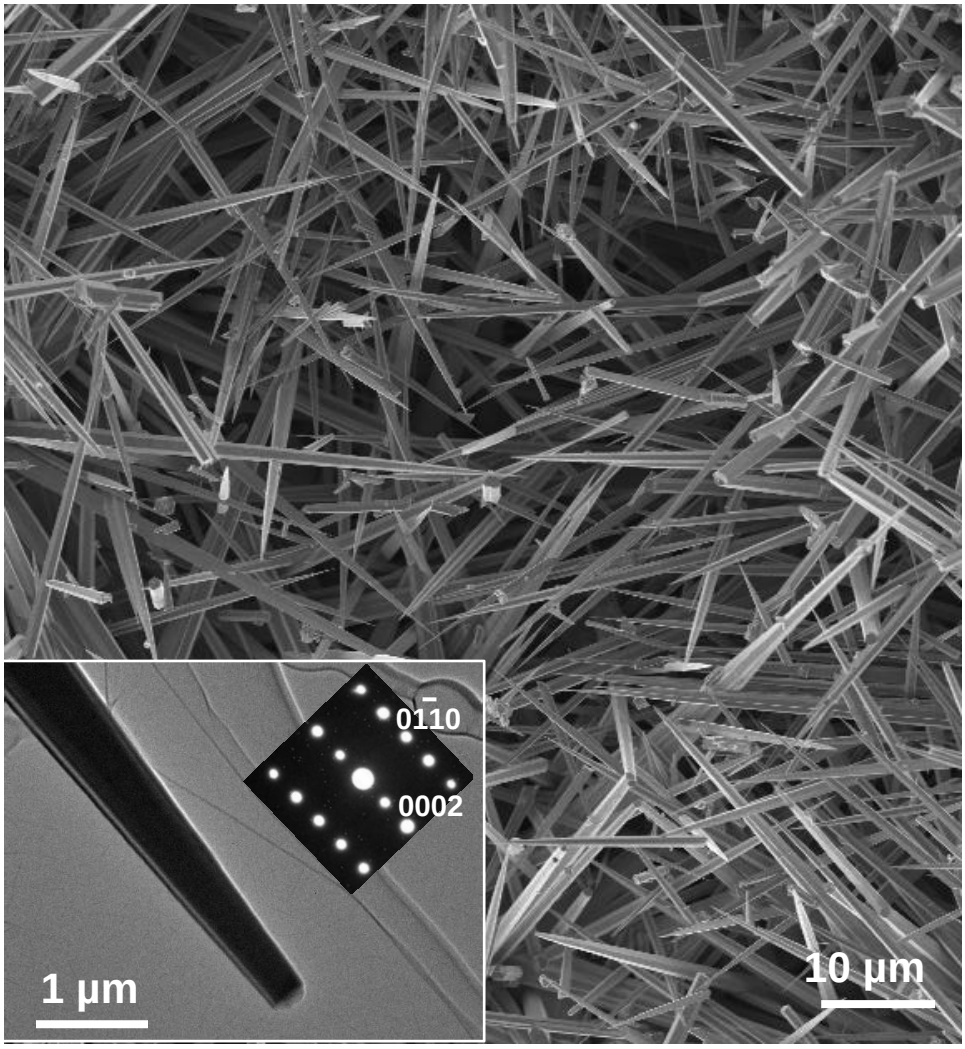

Figure S4. ZnO nanowires collected in region I. All the nanowires were single-crystalline and grew along the [0001] direction as illustrated in inset.

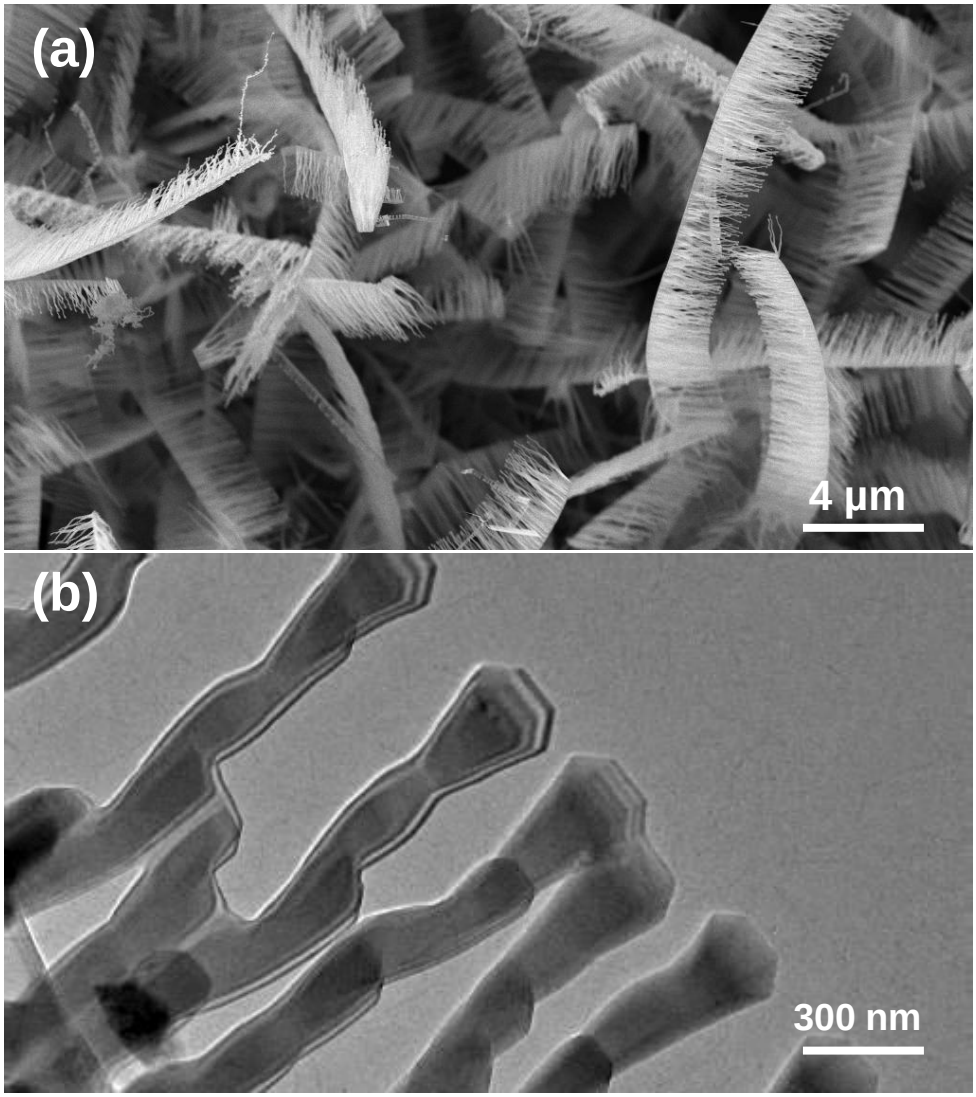

Figure S5. ZnO nanocombs that were observed in region II. Each cantilever of the nanocombs shows a flat tip indicating the absence of large quantity of Zn liquid state.

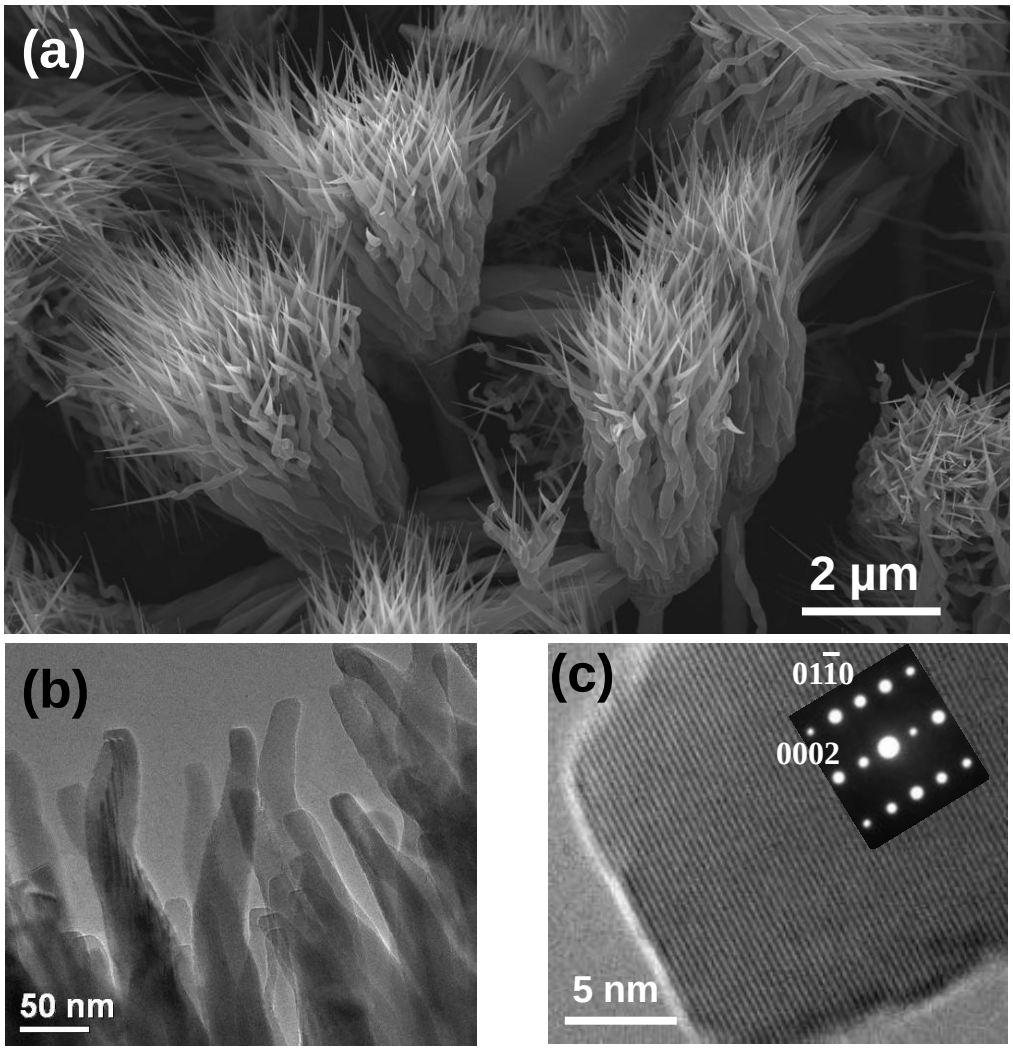

Figure S6. Bundles of small ZnO nanowires found between the region of nanoflower and nanocombs. A flat tip of the petal is observed to be the representative morphology of these small nanowires. Growth direction of these small nanowires is the same as the flower petals, which is along the [0001] direction.

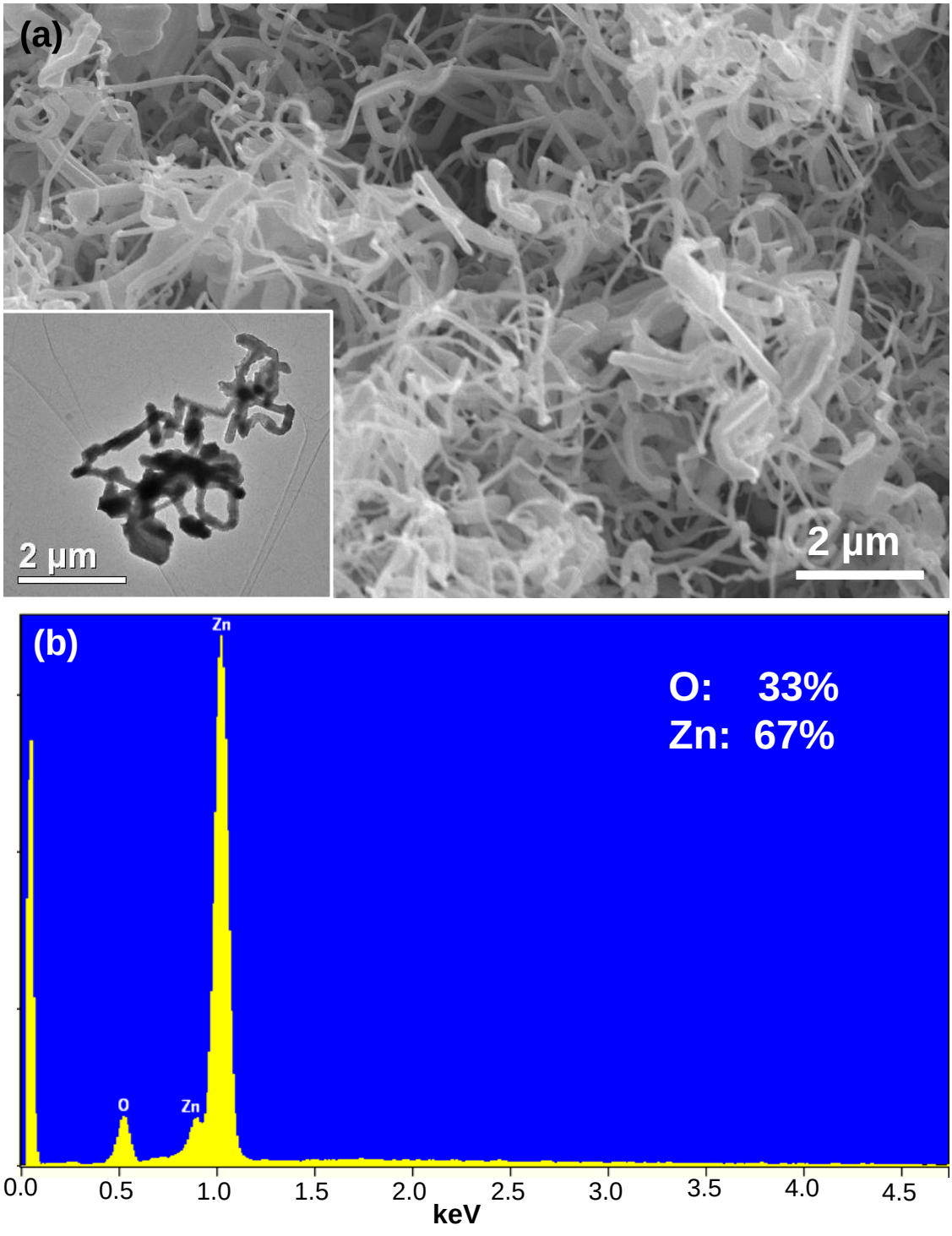

Figure S7. SEM image (a) and EDS spectrum (b) of Zn-ZnO core-shell nanowire structure collected in region IV. All the nanowires were very wavy and full of defects/dislocations.

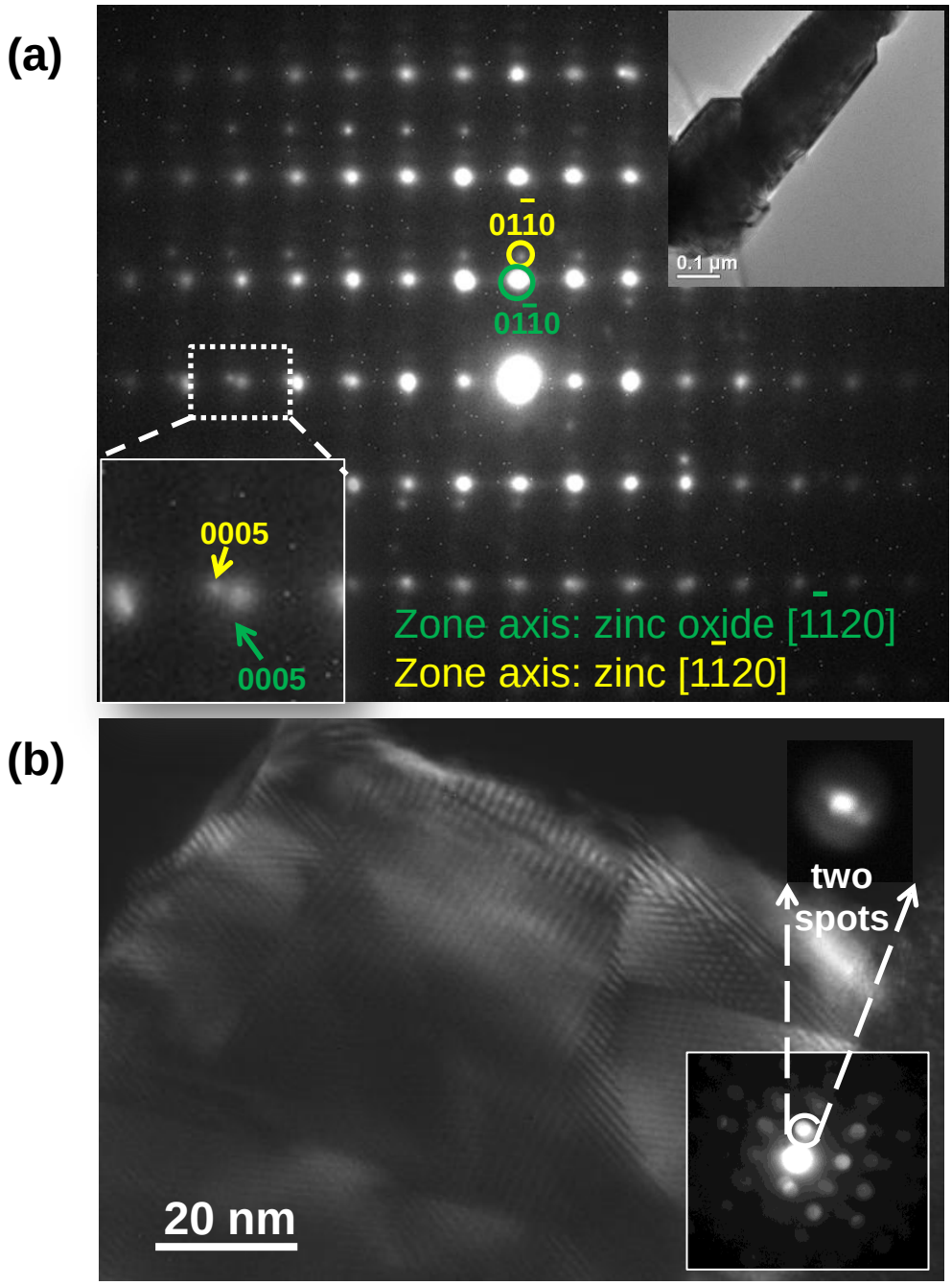

Figure S8. TEM analysis of the Zn-ZnO core-shell nanowires. (**a)** The presence of both the Zn and ZnO diffraction patterns. This suggests the existing of a possible epitaxial relationship between the Zn core and ZnO shell. (**b)** Morie fringes verify the epitaxial relationship. These evidences support the Wagner oxidation theory as described in main text.

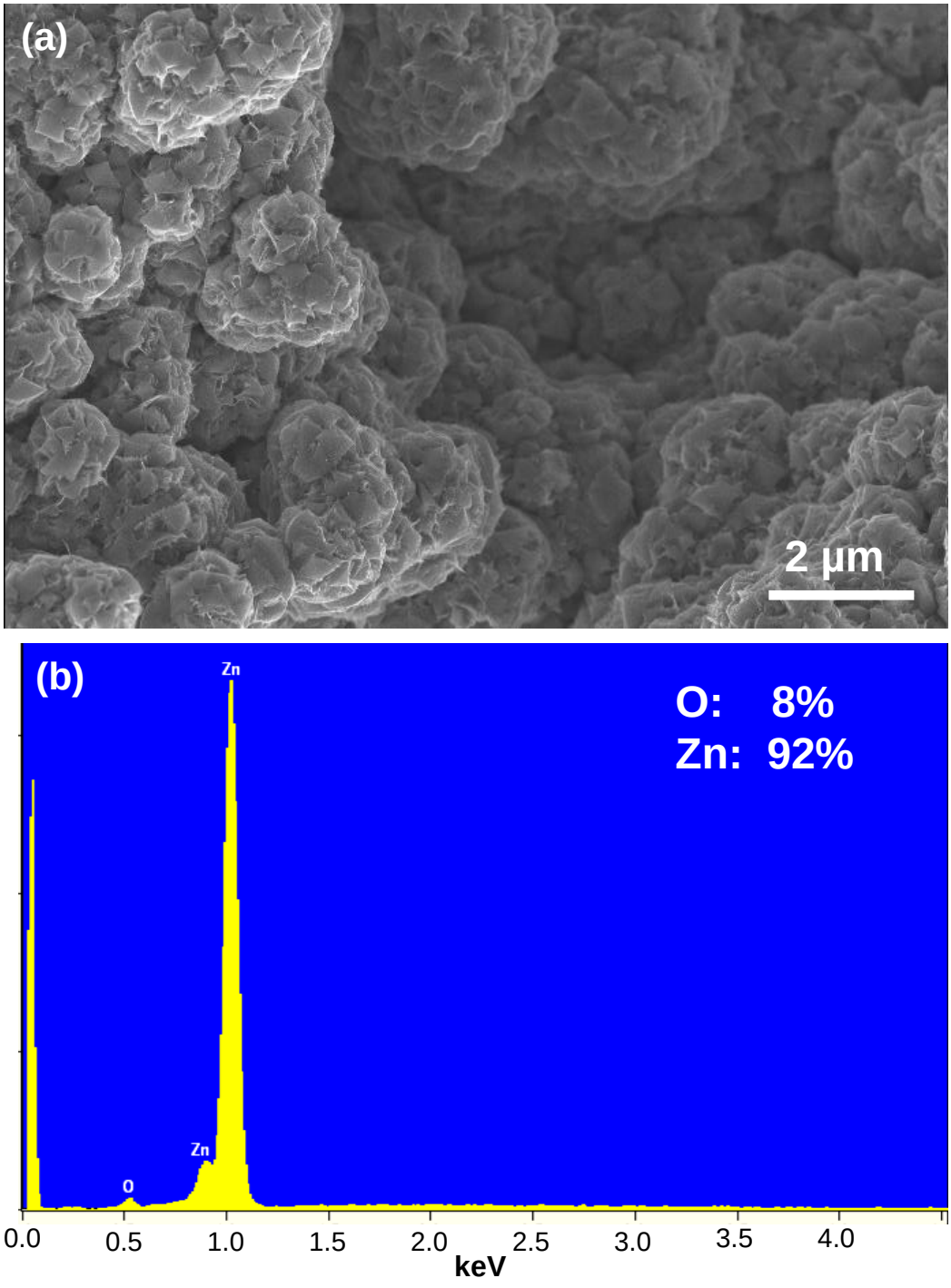

Figure S9. SEM image **(a)** and EDS spectrum **(b)** of metallic Zinc nanostructures which appeared black on the substrate.

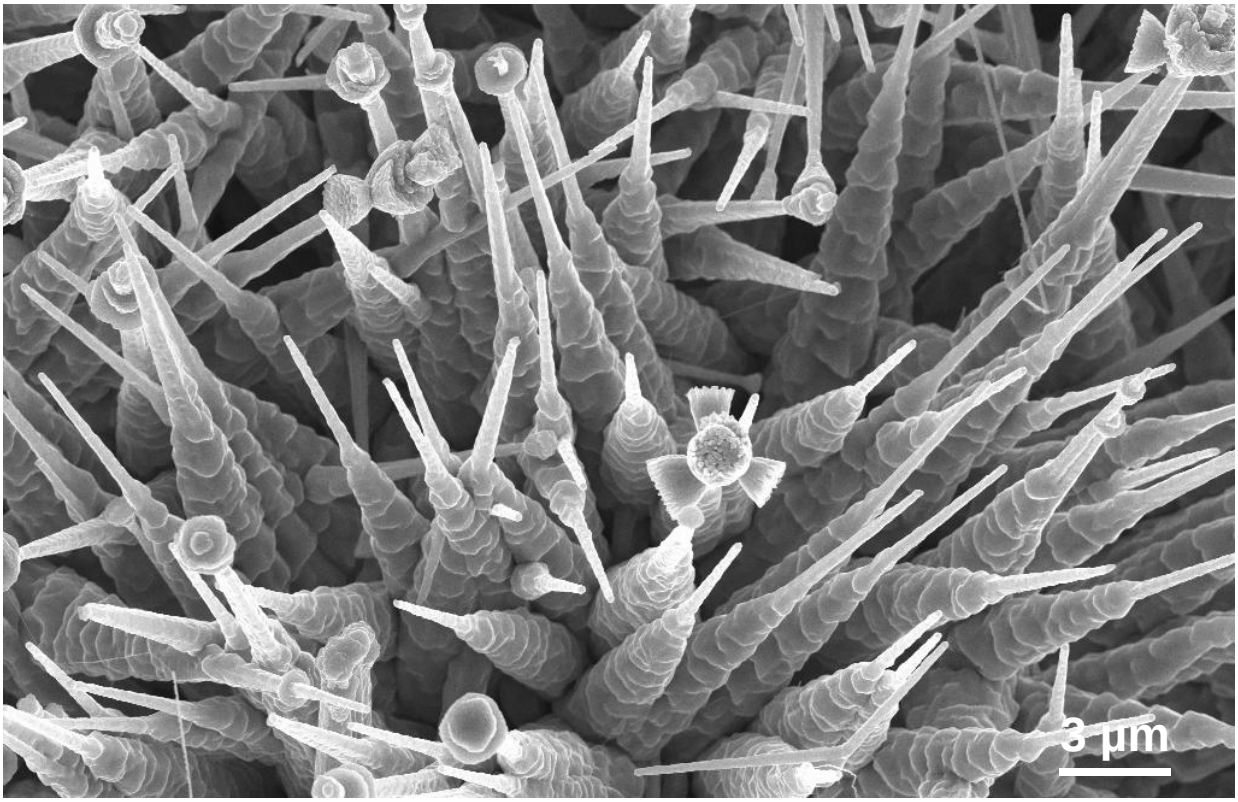

Figure S10. SEM image of ZnO nanostructures collected in a control experiment. By shutting down the furnace right before it reaches 1400 ^{o}C, we obtained "infant-state" nanoflowers which had a similar stem as the well-developed nanoflowers and embryonic flower corollas.