Supporting Information

Ultra-stable ZnO nanobelts in electrochemical environments

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The scanning electron microscopy (SEM) was used to characterize the morphology of In-ZnO nanobelts prepared by the CVD method, as shown in Figure S1. (a-b). It can be seen that the nanobelts have good uniformity.

In Figure S1(c-d), the main diffraction peaks of In-ZnO nanobelts still corresponded to the diffraction peaks of pure ZnO nanobelts. It was clear that the (102), (110) crystal plane moved to the small angle direction. Through the XRD analysis, it could be seen that indium ions replaced zinc ions successfully[1]

The XPS had also been carried out, as shown in Figure S1(e). The stoichiometric ratio of the In-ZnO nanobelts could be got through the XPS measurements. In this experiment, the atomic concentrations for Zn, In, and O were estimated to be 30.81%, 7.55%, and 61.64%, respectively. The high proportion of O atoms is due to the oxygen adsorption that is difficult to avoid on the surface of ZnO. The In atoms and Zn atoms didn't form any chemical bond indicated that the vast majority of In atoms occupied the place of Zn atoms in the indium doping process. Because the radius of

In element (ionic radius is 0.81 Å, covalent radius is 1.50 Å) was larger than that of Zn element (ionic radius is 0.74 Å, covalent radius is 1.25 Å)[2], the doping of indium element caused the stereo-hindrance effect[3-5]. The stereo-hindrance effect would reduce the atomic interaction space and cut the number of hydrogen ions that intruded into the internal structure in the corrosion process. Because of the stereo-hindrance effect, the quantity of ion exchange got worse, which could decrease the corrosion rate.

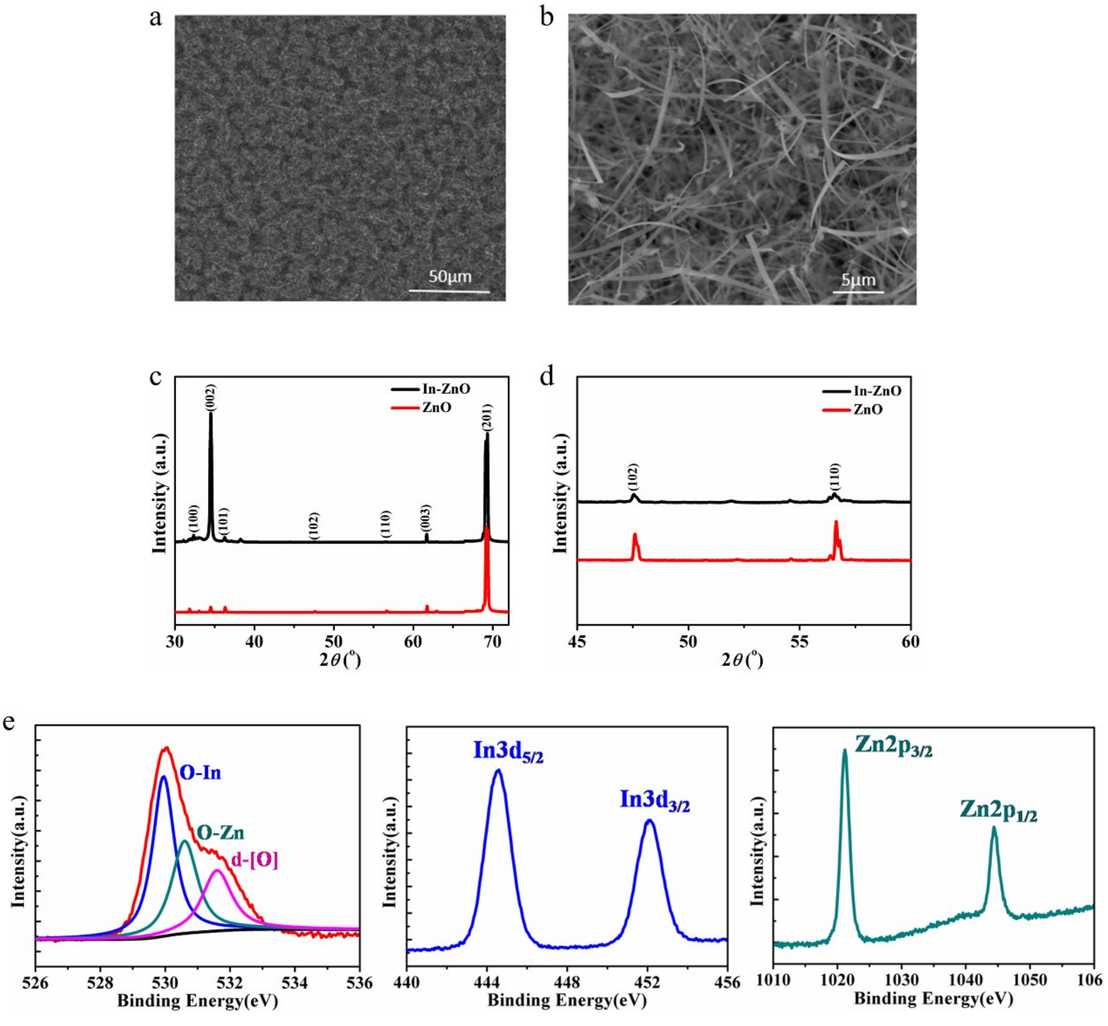

Figure S1. (a-b) SEM images of In-ZnO nanobelts at different multiples (a) Scale bar, 50μm, and (b) Scale bar, 5μm, respectively. (c-d) XRD pattern and the local high magnification images of In-ZnO nanobelts. (e) High-resolution XPS spectra of In-ZnO nanobelts, the V-[O] represented for oxygen vacancy.

The schematic processes of the clean-dry transfer method used in this work are shown in Figure S2.

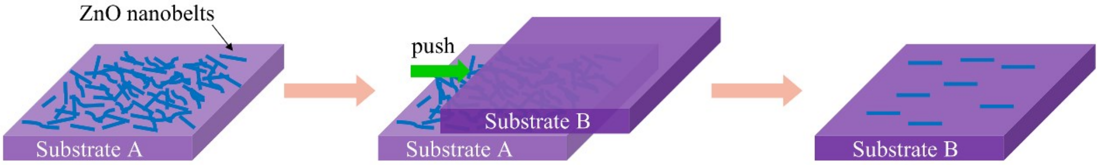

Figure S2. The schematic processes of the clean-dry transfer method used in this work.

As previous work presents, stress can accelerate the corrosion process[6]. So, the research on the surface morphology of a bent In-ZnO nanobelt for different corrosion time was investigated. In this paper, an In-ZnO nanobelt in the working stress state was prepared (as exhibited in Figure S2). In the HCl solution (PH ≈ 6), it can be seen that the surface morphology kept integrally well after corrosion of 36.5 h, which illustrated that the In-ZnO nanobelt in stress state had the structural stability in the acidic environment.

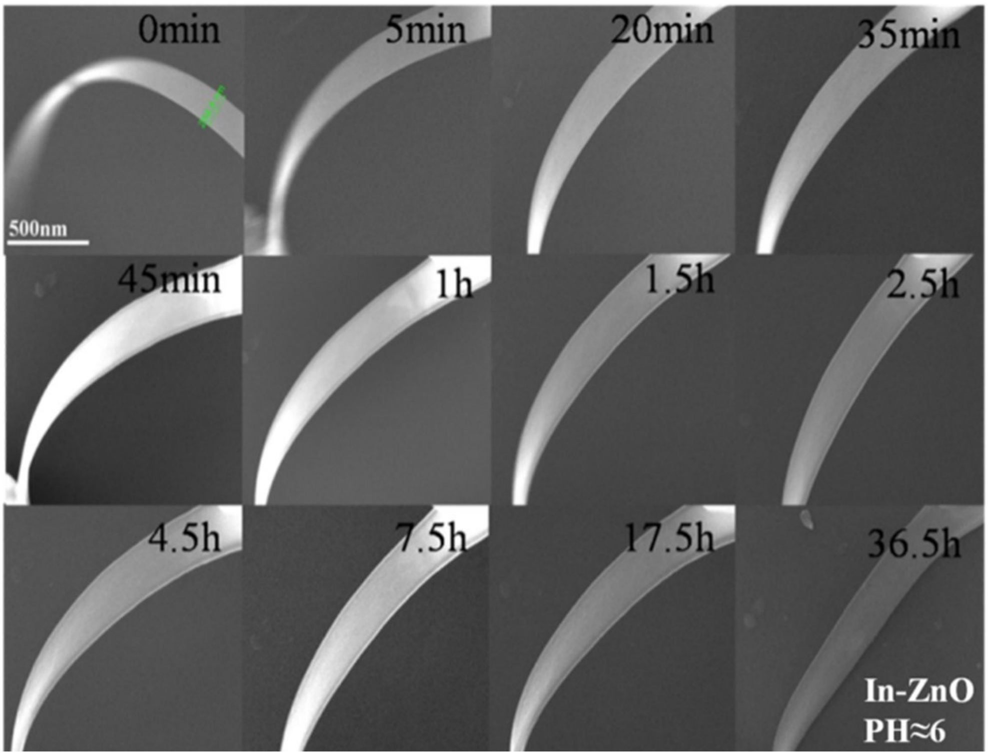

Figure S3. SEM images of a bent In-ZnO nanobelt in the acidic solution of PH≈6 for different corrosion time.

References

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