Dislocation-Driven Growth of CuO Nanowires

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Nanowire is an important nanomaterial that have shown various new physical properties and demonstrated promising applications. The properties of nanowires are depended on the morphology, structure and defects, which are related to the growth conditions and mechanism. Screw dislocation driven growth [1, 2], a one dimensional growth under low supersaturations, was proposed to explain the growth of whiskers in 1950s with the development of crystal growth theory. The screw dislocation located in the axis of nanowire provides a self-perpetuating step, which promote the one-dimensional growth with a catalyst-free growth condition. However, the screw dislocation could not be confirmed easily in limited experimental condition at that time. In recent years, the dislocation-driven growth mechanism was reported in the growth of PbS [3], ZnO [4] nanowires etc.

In this work, the CuO nanowires were synthesized by thermal oxidation method, the crystal structure and growth mechanism of CuO nanowires were revealed. Structural characterizations were carried out by electron microscopy, the morphology of CuO nanowire was shown in Figure 1(a), there was a dislocation contrast along with the nanowire. The high resolution transmission electron microscope (HRTEM) analysis showed the twinned structure, the growth direction of CuO nanowires was confirmed to be [110] direction, as shown in Figure 1 (b-c). To identify the Burgers vector of the dislocation, the TEM contrast analysis under two-beam conditions was carried out. With specific reciprocal space diffraction spots (***g***), the dislocation contrast was visible, as shown in Figure 1 (e), (h)and (i), while invisible which were shown in Figure 1 (f), (g) and (j). According to the invisibility criterion, the Burgers vector was determined to be along with [110] direction, confirming that the dislocation was a screw dislocation. Indicating the screw dislocation drives the one dimensional growth of CuO nanowires.

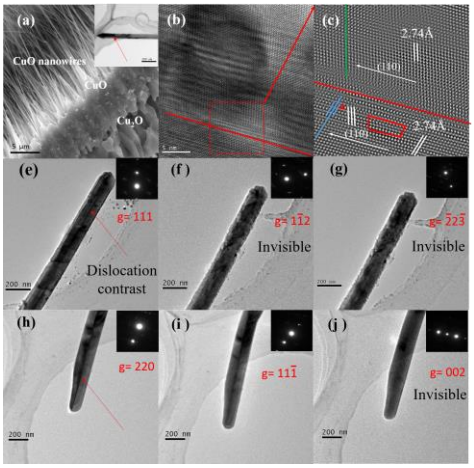

Figure 1. The morphology and structural analysis of CuO nanowires

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