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In situ cooling and heating study of VO_2 phase transition

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Vanadium dioxide (VO_2), one the correlated electron material has received many attentions through a metal-insulator transition (MIT) at ~ 340°K, close to room temperature. The transition in VO_2 associated by structural phase transition from the monoclinic (M_1), insolating phase, to rutile(R), metallic phase. This metal-insulator transmission is accompanied by a noticeable resistivity, optical transparency and magnetic changes. In addition, large hysteresis effects are reported at nanoscale size VO_2, which opens much more application possibility such as gas sensors and optical data storage. However, there is still no clear explanation on hysteresis effect variations of different VO_2 morphologies.

In this work, we used aberration corrected scanning transition electron microscopy and in situ transition electron microscopy (TEM) cooling and heating techniques to study the different VO_2 samples. The atomic resolution image of W-doped sample (x=0.8 atom %) Figure 1a. and corresponding diffraction patterns at 300 and 90 K are respectively shown in Figure 1b-c. This investigation correlates the atomic structural aspect of each sample to variations in hysteresis gap, which help controlling of the hysteresis properties for different needs.

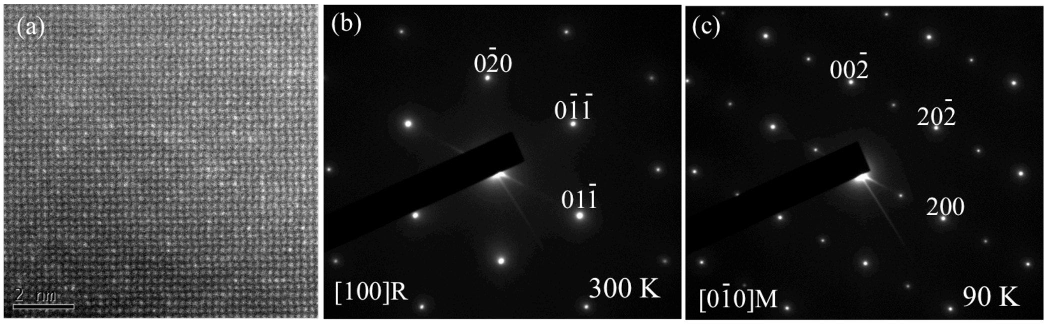

Figure 1. (a) Atomic resolution HAADF image of $W_xV_{1-x}O_2$ nanowires (x=0.8 atom%). (a-b) are SAED patterns of an individual single-crystalline nanowire at the 300 °K and 90 °K respectively.

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