The Scanning Photoelectron Microscopy Studies of Eu-treated ZnO Nanowires

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The scanning photoelectron microscopy (SPEM) were obtained at the 09A beamline , at the National Synchrotron Radiation Research Center in Hsinchu, Taiwan. Pure ZnO-NWs were grown by chemical vapor deposition, Eu-treated ZnO-NWs were obtained by thermal diffusion of Eu atoms into ZnO nanowires. The diameter of ZnO-NWs was approximately 200 nm; they were approximately 1 μm long. Details of the preparation of Eu-treated ZnO-NWs and ZnO-NWs can be found elsewhere [1].

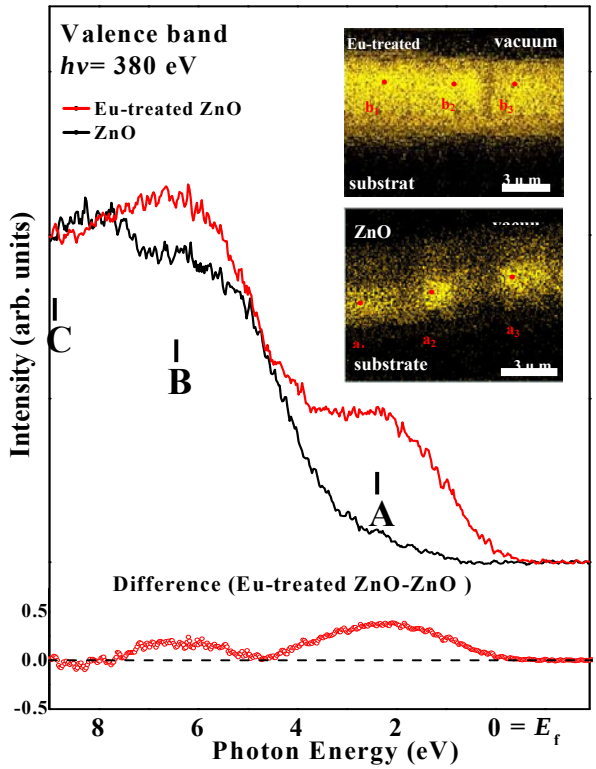

Fig. 1: (Color online):Valence-band photoemission (VB-PES) spectra of the Eu-treated ZnO and the untreated ZnO nanowires taken at a_1, a_2, and a_3 (upper inset) and b_1, b_2, and b_3 (lower inset), respectively.

The Fig. 1 presents the spatially resolved valence-band photoemission (VB-PES) spectra of the ZnO and the Eu-treated ZnO nanowires taken at three different locations (b1, b2, and b3 in treated sample (upper inset) and a1, a2, and a3 in untreated sample(lower inset)) at the cross-section of the ZnO samples. The locations were selected after identifying the Zn-rich region corresponding to the maximum Zn 3d intensities in the SPEM images as shown at the insets. The zero binding energy is set at the Fermi level. The diffusion of Eu onto the ZnO nanowires enhances the VB intensity at ~2 eV (A) and ~6 V (B), with slight decrease at 8 eV (C). The difference in the spectrum between the treated and the untreated sample is shown at the bottom of the figure. The feature at C is associated with O 2p and Zn 3d/4sp hybridized states, while the occupied O 2p state is reflected at B3 [2]. The feature at A3 lies near the Fermi edge and could be attributed to deep-defect and surface states/dangling bonds. However based on band structure calculations on Eu-doping on other related compounds [3, 4], the region near the Fermi edge is inferred to be contributed by the Eu 4f states.

References

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