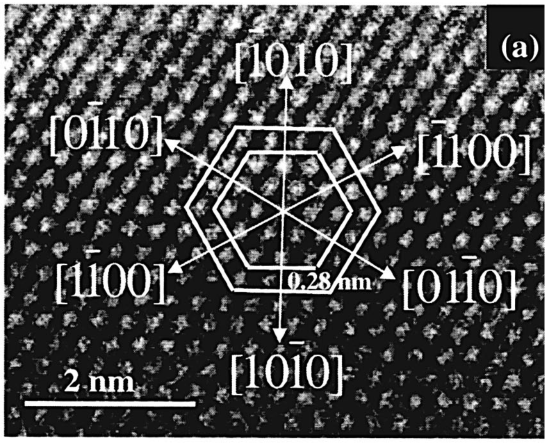

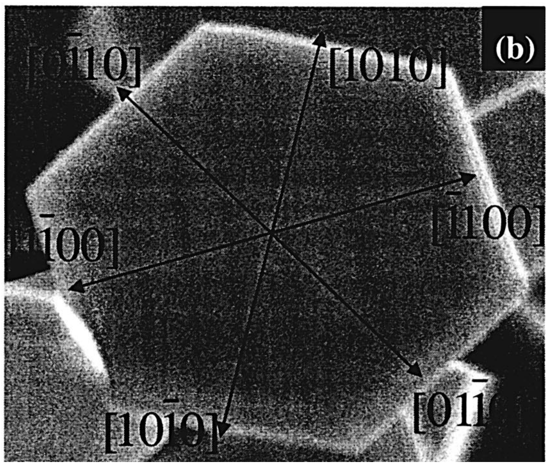

FIG. 4. (a) HRTEM image of a nanodisk with six-fold symmetry. The crystal orientations and the d-spacing are indicated. (b) The corresponding SEM image with crystal orientations indicated.

been observed in TEM chamber with high vacuum by electron beam irradiation of polyhedral Zn powders. For the hexagonal structural Zn and ZnO crystals, the top surface is (0002) plane and the side surfaces are $\{10\bar{1}0\}$ planes with low surface energy. If the (0002) facet of the crystallized ZnO are constantly kept clean and the newly incoming droplets can constantly wet and cover the entire condensed (0002) facet, the ZnO nanodisks with geometrical shape of hexagonal projections can be obtained.[2] In our experimental conditions, the mobility of the Zn atoms in vapor was high enough to form flat (0002) surfaces which prevented the accumulation of incoming atoms or molecules.[29] The smooth surface of the nanodisk, as shown in the SEM image in Fig. 4(b), provides the evidence for this assumption. The growth temperature was much higher than the melting point of metallic Zn (419 °C), therefore, it was high enough to keep the liquid state of the newly arriving droplets during the growth of ZnO nanocrystals. Due to suppression of growth on (0002) facet with the lowest energy, the crystals would grow mainly along the six directions of $\langle 10\bar{1}0\rangle$, which have the second lowest surface energy. The same growth velocity along these six directions leads to the formation of the six-fold symmetric nanodisks with hexagonal shape.

In summary, high yield nanodisks with perfect hexagonal shape have been fabricated by the VPT method. The analysis of the microstructure demonstrates that the large smooth surface of the nanodisks is (0002) plane and the six symmetric side surfaces are $\pm(10\bar{1}0)$, $\pm(1\bar{1}00)$, and $\pm(01\bar{1}0)$. The growth suppression along $+c$ axis is probably due to wet droplets of Zn under proper temperature and vapor pressure.

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