Hierarchical Nanowires on and Nanosticks in ZnO microtubes

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We report both coaxial core/shell structured microwires and ZnO microtubes with growth of nanosticks in the inner and nanowires on the outer surface as a novel hierarchical micro/nanoarchitecture. First, a core-shell structure is obtained - the core is formed by metallic Zn and the semiconducting shell is comprised by a thin oxide layer covered with a high density of nanowires. Second, microtubes, formed due to complete evaporation of the core, decorated with nanowires on the external surface are obtained [1]. In an intermediate stage, between coaxial core/shell structure and microtube formation, a hierarchical morphology comprised of discrete nanosticks in the inner surface of the microtube has been found. Hyperfine interaction measurements disclosed the presence of confined metallic Zn regions at the interface between linked ZnO grains forming a chain and a ZnO thicker layer. Surprisingly, the metallic Zn clusters form highly textured thin flat regions oriented parallel to the surface of the microtube as revealed by analyzing the electrical field gradient direction. The driving force to grow the internal nanosticks has been ascribed to stress-induced migration of Zn ions due to compressive stress caused by the presence of confined regions at the interface between ZnO layer and chain of ZnO grains that holds the nanosticks.

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