There has been increasing interest in intentional synthesis of nanowires and nanotubes based on a large variety of materials. A deeper understanding and a sufficient control of the growth of nanowires and nanotubes are in the center of current research interest. Strategies for position-controlled and nano-patterned growth of nanowire arrays will be demonstrated by selected examples based on ZnO nanowires as well as discussed in terms of larger scale realization and future prospects. The physical properties such as piezoelectric response and stimulated emission of single ZnO nanowires will be presented on selected examples.
Recently, we demonstrated one-dimensional free-standing spinel nanotubes which were transformed from ZnO/Al2O3 core-shell-nanowires via the Kirkendall effect in solid-state reaction. Atomic layer deposition was used to overgrow ZnO wires with a uniform Al2O3 shell. After annealing, the structure transforms into hollow ZnAl2O4 spinel tubes. Although we demonstrate here randomly oriented ultralong nanotubes, it is in principle possible to obtain vertically-aligned and regularly-ordered nanotubes following the same approach. Such ordered arrays of spinel nanotubes may possess similar application potentials as carbon nanotubes. The nanoscaled Kirkendall effect could provide a general fabrication route to hollow nanostructures, including complex hollow nanostructures.


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