

Helical Structure of ZnGa_2O_4 Nanowires

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Two unique helical ZnGa_2O_4 nanostructures; nanovines and nanosprings, were synthesized by thermal evaporation of ZnO/Ga powders at 600 or 900 °C, using pre-grown ZnSe nanowires as templates. The detail structural and optical properties were investigated by scanning electron microscopy, transmission electron microscopy, high-voltage electron microscopy, energy dispersive X-ray spectroscopy, photoluminescence, and X-ray diffraction. They have four equivalent growth directions of $\langle 011 \rangle$ with the axial direction of $[001]$. They have four equivalent growth directions of $\langle 011 \rangle$: $[011]$, $[101]$, $[0\bar{1}1]$, $[\bar{1}01]$, with the axial direction of $[001]$. We suggest that the lattice matching with the ZnSe nanowires is an important factor in determining the growth direction of the helical ZnGa_2O_4 . The $\text{ZnGa}_2\text{O}_4/\text{ZnSe}$ nanovines exhibit strong blue/red emission. These $\text{ZnGa}_2\text{O}_4/\text{ZnSe}$ nanovines could be used as a distinctive multicolored light-emitting-diode nanomaterial.