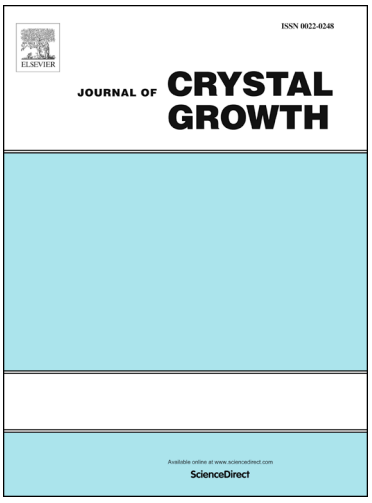

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Synthesis of highly conductive thin-walled Al-doped ZnO single-crystal microtubes by a solid state method

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Abstract: ZnO has attracted considerable attention in fundamental studies and practical applications for the past decade due to its outstanding performance in gas sensing, photocatalytic degradation, light harvesting, UV-light emitting/lasing, *etc*. The large-sized thin-walled ZnO (TW-ZnO) microtube with stable and rich V_{Zn}-related acceptors grown by optical vapor supersaturated precipitation (OVSP) is a novel multifunctional optoelectronic material. Unfortunately, the OVSP cannot achieve doping due to the vapor growth process. To obtain doped TW-ZnO microtubes, a solid state method is introduced in this work to achieve thin-walled Al-doping ZnO (TW-ZnO:Al) microtubes with high electrical conductivity. The morphology and microstructures of ZnO:Al microtubes are similar to undoped ones. The Al^{3+} ions are confirmed to substitute Zn^{2+} sites and Zn(0/-1) vacancies in the lattice of ZnO by EDS, XRD, Raman and temperature-dependent photoluminescence analyses. The Al dopant acting as a donor level offers massive free electrons to increase the carrier concentrations. The resistivity of the ZnO:Al microtube is reduced down to ~10^{-3} Ω•cm, which is one order of magnitude lower than that of the undoped microtube. The present work provides a simple way to achieve doped ZnO tubular components for potential device applications in optoelectronics.

Keywords: A1. Doping; A1. Characterization; A3. Optical vapor supersaturated precipitation; A3. Solid state method; B1. Zinc compounds; B2. Semiconducting II-VI materials

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