403d Flame Synthesis of Doped Zno Nanorods

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Nanorods are nanoscale particles with an aspect-ratio (ratio of length to diameter) greater than unity and a dominant linear, 1-dimensional geometry. Depending on the material composition, nanorods may exhibit unique electronic, optical and mechanical properties that appeal to a range of applications including electronics, sensors, optical components and displays, polymer-composites, and actuator devices. Synthesis of nanorods is typically carried out via vapour-phase (eg. evaporation/condensation) or wet-chemistry (eg. solvothermal) routes. Despite being capable of producing well-controlled material uniformity and properties, these techniques are limited in their scale-up potential. In this work we report the flame-aerosol synthesis of doped zinc-oxide nanorods with closely controlled aspect ratio. Zinc-oxide nanorods doped with indium, tin or lithium dopant species at concentrations up to 10 at.% preserve the single-phase ZnO wurtzite structure. In and Sn dopants alter the shape of the ZnO particles, inducing a rod-like geometry with increasing dopant concentration. The aspect ratio for both the In- and Sn-doped ZnO crystals increased by a factor of 5 from 0.6 to over 3 as dopant was increased up to 10 at.% as measured by X-ray diffraction (XRD). This was confirmed by transmission electron microscopy (TEM), indicating a prevalence of nanorod structures with increasing dopant concentration. This work demonstrates the synthesis of nanorods unambiguously in the vapour-phase in contrast to tubular-reactor type methods and provides an efficient route to scale-up of a novel nanorod material.