# Chemical Synthesis of p-type Zinc Oxide Nanostructures

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Zinc Oxide (ZnO) has emerged during the past few years as a promising material for various optoelectronic applications. A major advantage of ZnO is that in contrast to other semiconductors available for solid state light emitters it can be produced by low-cost chemical synthetical routes. A plethora of nanostructures can be fabricated via the control of simple key parameters (e.g. the nutrient solution concentration, pH and temperature, the growth duration etc). Nonetheless, regardless of the fabrication method, a major hurdle in developing viable devices is the ability to produce p-type ZnO. Nominally-undoped ZnO generally exhibits n-type conductivity due to native donor defects, such as zinc interstitials and oxygen vacancies [1], which cause self-compensation when attempting to dope the material by introduced acceptors. On the other hand, most p-type dopants result into deep acceptor levels that are prohibitive for efficient device operation. In recent years, considerable efforts have been made to create p-type ZnO, but the subject has remained largely controversial.

This work focuses on the hydrothermal synthesis of p-type ZnO with lithium (Li) selected as the potential dopant. Li-doped ZnO nanostructures/nanowires were grown on Si substrates with the main focus to develop an inexpensive, versatile and facile methodology compatible with standard microfabrication techniques that can be readily transferred to mass-production. Several doping levels were attempted and a comprehensive study including Field Emission Scanning Electron Microscopy, X-ray Diffraction, Photoluminescence at room temperature and 15K and Raman Spectroscopy was conducted to elucidate whether it is feasible to obtain p-type Li-doped ZnO via a purely chemical method and to unravel the mechanisms involved in the lattice formation during the hydrothermal growth of Li-doped ZnO.

References:

1. A. Janotti, C. G. van de Walle, *Phys. Rev. B* **76,** 165202 (2007)