Pengaruh doping Cu terhadap morfologi, struktur mikro dan sifat optik nanorod ZnO = The influence of Cu doping on morphology micro structure and optical properties of nanorod ZnO

Jeffry Marselie, author

Abstrak

Material Seng Oksida (ZnO) adalah salah satu material semikonduktor yang sedang banyak diteliti yang banyak diaplikasikan pada devais optoelektronik dan aplikasi fotokatalitik. Material ZnO dapat diubah sifatnya melalui penambahan doping. Dalam penelitian ini, nanorod ZnO disintesis dengan lima variasi doping Cu (0%, 1%, 4%, 7% dan 10%) melalui 2 tahap yaitu tahap deposisi lapisan benih di atas subtrat indium tin oxide (ITO) menggunakan metode ultrasonic spray pyrolisis dan tahap penumbuhan nanorod ZnO menggunakan metode hidrotermal. Karakterisasi nanorod ZnO meliputi morfologi permukaan oleh scanning electron microscopy (SEM), struktur kristal oleh x-ray diffraction (XRD), dan sifat optik oleh ultraviolet-visible spectroscopy (UV-Vis) dan fotoluminisen (PL).
Hasil penelitian menunjukkan bahwa nanorod ZnO ditumbuhkan dengan bentuk hexagonal dan orientasi tumbuh beragam. Umumnya penambahan doping Cu menyebabkan peningkatan densitas, penurunan diameter, penurunan parameter kisi dan volume kristal nanorod ZnO. Penambahan konsentrasi doping Cu menurunkan absorbansi pada daerah panjang gelombang ultraviolet, meningkatkan nilai bandgap dan menurunkan puncak luminisensi di daerah ultra violet dan cahaya tampak. Dari hasil ini penulis menyimpulkan bahwa penambahan Cu sebesar 4 % pada struktur nanorod ZnO paling optimal untuk aplikasi devais optoelektronik dan fotokatalisis karena tingginya absorbansi di daerah ultraviolet dan rendahnya cacat yang terbentuk.
<hr>Material Zinc Oxide (ZnO) is a semiconductor material that has been researched widely for optoelectronic devices and photocatalytic applications. The characteristic ZnO material can be changed by the addition of doping. In this study, the nanorod ZnO were synthesized with five variations of doping Cu (0%, 1%, 4%, 7% and 10%) through two phases: the deposition of seed layer over a substrate of indium tin oxide (ITO) using ultrasonic spray pyrolisis and the growth of ZnO nanorod using hydrothermal method. The characterization of ZnO nanorod include surface morphology by scanning electron microscopy (SEM), the crystal structure by x-ray diffraction (XRD), and optical properties by ultraviolet-visible (UV-Vis) and photoluminisence (PL) spectroscopy.
The results showed that ZnO nanorod were grown with a hexagonal shape with diverse growth orientation. Generally, the addition of Cu doping led to an increase in density, diameter reduction, a decrease in the lattice parameter and crystal volume of ZnO nanorod. The addition of Cu doping also decreases the absorbance at ultraviolet wavelength region, increasing the band gap and reducing luminesence peak in the region of ultraviolet and visible light. From these results the author concluded that the addition of 4% Cu on ZnO nanorod stucture is the most optimal for optoelectronic devices and photocatalytic applications due to the high absorbance in the ultraviolet region and the low defects are formed.