THESIS: Synthesis and Characterizations of CuO/ZnO Nanowire Hetero-hierarchical Structure
DEPARTMENT: School of Physics
SPECIALIZATION: Physics
UNDERGRADUATE: Kenan Li
MENTOR: Prof. Shaoguang Yang

ABSTRACT:

In this thesis, CuO nanowires, ZnO nanowires and CuO/ZnO nanowire hetero-hierarchical structures were synthesized. The growth mechanism and doping magnetism were also investigated. XRD, SEM and SQUID were used for the characterization of the composition, the microstructure and the magnetic property of the sample.

Firstly, CuO nanowire array with smooth and neat macro-surface was prepared on Cu substrate via thermal oxidation method. The diameter and length of individual nanowire were approximately 150nm and several tens of micrometers respectively. Mn-Cu alloy slices were employed to synthesize Mn-doped CuO nanowires with low temperature ferromagnetism (60K) via thermal oxidation method.

Secondly, ZnO nanowires and Mn-doped ZnO nanowires with room temperature magnetism were synthesized via hydrothermal method using zinc nitrate, hexamethylenetetramine and manganese chloride as the hydrothermal solvent. ZnO nanowire array was synthesized on Si substrate via chemical vapor deposition using ZnO/C powder mixture as the evaporation source. The diameter and length of individual nanowire were approximately 200nm and 5μm respectively.

Thirdly, three-step method, thermal oxidation, seeding, and hydrothermal method, was employed to synthesize the CuO/ZnO nanowire hetero-hierarchical structures, forming point-to-point p-n hetero-junctions. By referring to the methods of doping Mn into CuO and ZnO nanowires, three-step method was employed to synthesize the Mn-doped CuO/ZnO nanowire hetero-hierarchical structures.

KEY WORDS: Nanowire; Hierarchical Structure; CuO; ZnO