A strategy to improve the chemical stability of ZnO nanowire under wet solution for chemical sensor applications

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Zinc oxide (ZnO) nanowire is one of the best semiconducting materials in term of its superior properties, such as large piezoelectric constant, wide band gap energy (3.37 eV), large exciton binding energy (60 meV), high thermal and mechanical stability. Therefore, it is suitable for the fabrication of variety of devices which includes transparent transistors, optoelectronic devices, chemical and biological sensing. Although ZnO nanowires are one of the promising candidates for various applications, robust surface functionalization methods with solubility and chemical stability under wet solutions still remain a great challenge for chemical sensor applications. In this work, we present schematic studies of chemical stability for functionalization methods of ZnO nanowires, including covalent bonding of the silane based modifier and surface polymerization using plasma for chemical sensor. The chemical stability and pH sensing of the functionalized ZnO nanowires were evaluated under various pH solutions. Surface reaction mechanisms for the nanoscale chemical sensors will be discussed with experimental evidence. This study provides useful guidelines for optimizing the stability and sensor performance for chemical sensor.