Biofunctionalization strategies of ZnO nanowires with high chemical stability for biosensor applications

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Zinc oxide nanowire is believed to one of the most important semiconducting materials because of its superior properties, such as wide band gap energy (3.37 eV), large exciton binding energy (60 meV) and high mechanical stability. Therefore, it is suitable for the fabrication of variety of devices which includes chemical and biological sensing. Although ZnO nanowires are one of the promising candidates for various applications, robust surface functionalization methods with chemical stability in acidic solution and biomolecule immobilization on nanowires surface still remain a great challenge for biological sensor applications. In this work, we present schematic studies of chemical stability for functionalization methods of nanowires including covalent bonding of the silane based modifier and surface polymerization for immobilization of biomolecules on the nanowire surface. The stability of functionalized nanowires was evaluated under various pH solutions. The chemical modification and solubility of nanowires were investigated by SEM, TEM, and FT-IR. Based on the optimized biofunctionalization method, the nanowires with biomolecules immobilized on the surface were evaluated using fluorescence microscopy and FET with electrolyte gate configuration for biosensor applications.