Surface-Initiated Atom Transfer Radical Polymerization on Gold Nanoparticle for Immunosensing

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Colloidal gold is a very attractive label for detection of biomolecules due to its unique optical properties [1,2]. Since the colorimetric biosensor based on gold nanoparticles (GNPs) was developed by Mirkin and co-workers [3], this platform has been investigated extensively on the detection of target analytes, such as small molecules, heavy metal ions, nucleic acids, proteins, enzymatic activity, saccharides and cells. Atom transfer radical polymerization (ATRP) is well-known as a popular means to construct well-defined polymer structures. And due to mild reaction conditions and facility conjugated on biomolecules, it has been more widely adopted to prepare polymer-coated GNPs [4,5]. Based on this platform, we investigate a novel method for immunoassay with grafting polymer on the biomolecules modified colloid gold nanoparticles combined with surface-initiated ATRP. As the optical properties of GNPs have connected with their surface functionalization, we use this feature to detect the target analytes. The amount of identified initiator labeled antibody on the surface of GNPs is varied with the amount of target analytes in solution, and the amount of grafted polymer is depended on the initiated sites. According to this principle, we realize the detection of target analytes which utilizes the change of optical properties induced by surface modification of GNPs, Scheme. This method has been proved to be well reproducibility, high sensitivity and good stability. In addition, the results show the linear range for the detection of IgG is 0.5–25 ng/mL and the detection limit reaches to 0.03 ng/mL.

Scheme. Schematic illustration of SI-ATRP on gold nanoparticle for immunoassensing