

Role of NaCl and Temperature in Glycerol Mediated Rapid Growth of Silver Nanostructures

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Abstract : One dimensional silver nanowires and nanoparticles gained more interest in developing transparent conducting films, catalysis, biological and chemical sensors. Silver nanostructures can be synthesized by varying reaction conditions such as the precursor concentration, molar ratio of the surfactant, injection speed of silver ions, etc. in the polyol process. However, the reaction proceeds for greater than 2 hours for the formation of silver nanowires. The introduction of etchant in the medium promotes the growth of silver nanowires from silver nanoparticles along the [100] direction. Rapid growth of silver nanowires is accomplished using the Cl⁻ ions from NaCl and polyvinyl pyrrolidone (PVP) as surfactant. The role of Cl⁻ ion was investigated in the growth of the nanostructured silver. Silver nanoparticles (<100 nm) were harvested from glycerol medium in the absence of Cl⁻ ions. Trace amount of Cl⁻ ions (2.5 mM -NaCl) produced the edge joined nanowires of length upto 2 μm and width ranging from 40 to 65 nm. Formation and rapid growth (within 25 minutes) of long, uniform silver nanowires (upto 5 μm) with good yield were realized in the presence of 5 mM NaCl at 200°C. The growth of nanostructures was monitored by UV-vis-NIR spectroscopy. Scanning and transmission electron microscopes reveal the morphology of the silver nano harvests. The role of temperature in the reduction of silver ions, growth mechanism for nanoparticles, edge joined and straight nanowires will be discussed.

Keywords : silver nanowires, glycerol mediated polyol process, scanning electron microscopy, UV-Vis- NIR spectroscopy, transmission electron microscopy

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