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Synthesis of Core-shell Copper nanowire with Reducible Copper Lactate Shell and its Application

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We present the concept of reducible fugitive material that conformally surrounds core Cu nanowire (NW) to fabricate transparent conducting electrode (TCE). Reducing atmosphere can corrodes/erodes the underlying/surrounding layers and might cause undesirable reactions such impurity doing and contamination, so that hydrogen-/forming gas based annealing is impractical to make device. In this regards, we introduce novel reducible shell conformally surrounding indivial CuNW to provide a protection against the oxidation when exposed to both air and solvent. Uniform copper lactate shell formation is readily achievable by injecting lactic acid to the CuNW dispersion as the acid reacts with the surface oxide/hydroxide or pure copper. Cu lactate shell prevents the core CuNW from the oxidation during the storage and/or film formation, so that the core-shell CuNW maintains without significant oxidation for long time. Upon simple thermal annealing under vacuum or in nitrogen atmosphere, the Cu lactate shell is easily decomposed to pure Cu, providing an effective way to produce pure CuNW network TCE with typically sheet resistance of 19.8 Ω /sq and optical transmittance of 85.5% at 550 nm. Our reducible copper lactate core-shell Cu nanowires have the great advantage in fabrication of device such as composite transparent electrodes or solar cells.

Keywords: Copper nanowire, core-shell structure, reducible shell, transparent electrode

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Study of SF₆/Ar plasma based textured glass surface morphology for high haze ratio of ITO films in thin film solar cell

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The front transparent conductive oxide (TCO) films in thin fill solar cell should exhibit high transparency, conductivity, good surface morphology and excellent light scattering properties. The light trapping phenomenon is limited due to random surface structure of TCO films. The proper control of surface structure and uniform cauliflower TCO films may be appropriate for efficient light trapping. We report light trapping scheme of ICP-RIE glass texturing by SF₆/Ar plasma for high roughness and haze ratio of ITO films. It was observed that the variation of etching time, pattern size and Ar flow ratio during ICP-RIE process were important factors to improve the diffused transmittance and haze ratio of textured glass. The ICP-RIE textured glass showed low etching rates due to the presence of metal elements like Al, B, F and Na. The ITO films deposited on textured glass substrates showed the high RMS roughness and haze ratio in the visible wavelength region. The change in surface morphology showed negligible influence on electrical and structural properties of ITO films. The ITO films with high roughness and haze ratio can be used to improve the performance of thin film solar cells.

Keywords: Light trappings scheme, SF₆/Ar plasma, XPS, RMS roughness, Haze ratio, Thin film solar cell