Electrodeposition of 1-D tellurium nanostructure on gold surface from choline chloride-urea and choline chloride-ethylene glycol mixtures

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The electrodeposition of Te on Au substrate was investigated in either choline chloride-urea and in choline chloride-ethylene glycol deep eutectic solvents, at a molar ration of 1:2, containing 0.05 mol L?1 TeCl4. The electrodeposition of Te on Au electrode followed a three-dimensional progressive nucleation mechanism in both eutectic solvents. The diffusion coefficients of Te4+ species as a function of temperature were well fitted by a like-Arrhenius equation in both plating solutions. The apparent activation energies were 22.20 and 22.55 kJ mol?1 for Scharifker-Hills and Cottrell's models, respectively, in 1ChCl:2EG. On the other hand, in 1ChCl:2 U these values were 59.20 and 57.80 kJ mol?1. In addition, SEM micrographs of Te electrodeposits from both revealed a large-scale Te rods-like morphology with hexagonal cross-section in nanoscale regime uniformly distributed on electrode surface. TEM investigation suggested that Te single-crystalline grew perpendicular direction of (100) planes which implied in the preferential growth direction of [001].

Deep eutectic solvents

Electrodeposition

Nanorod

Nucleation/growth

Tellurium

Activation energy

Chlorine compounds

Electrodeposition

Electrodes

Ethylene

Ethylene glycol

Eutectics

Gold compounds

Metabolism

Morphology

Nanorods

Nucleation

Organic solvents

Polyols

Tellurium compounds

Urea

Apparent activation energy

Arrhenius equation

Deep eutectic solvents

Electrode surfaces

Hexagonal cross-sections

Preferential growth

Progressive nucleation

Single-crystalline

Tellurium