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Cathodic Deposition of Silicon from Phenyltrichlorosilane in an Organic Solvent

Ali H. Abbar[1,*] *and Sameer H. Kareem*[2]

[1] Chemical Engineering Department, College of Engineering Al- Qadessyia University, Iraq.
[2] College of Science for Women, Baghdad University, Iraq.
[*]E-mail: aliha68@yahoo.com

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The electrodeposition of silicon was carried out in acetone containing phenyltrichlorosilane and tetrabutylammonium chloride. Linear sweep voltammograms showed the possibility of electrodeposition of Si at −3.3V versus Pt quasi-R.E using a variety of cathode substrates including copper, brass, aluminum, stainless steel, titanium and amalgamated copper. Titanium and amalgamated copper electrodes have been given the highest current at the center of reduction wave. Potentiostatic electrolysis yielded porous deposit at −3.3V using titanium or amalgamated copper substrates. EDX results indicated that the electrodeposited Si was so active that it was oxidized immediately in the air. The AFM picture and granularity distribution chart for silicon film on titanium cathode showed that the silicon deposit is amorphous because the lateral extension of the finer corrugation is within the range of sizes expected for quantum wires. While no amorphous silicon can be obtained on amalgamated copper cathode in spite of giving higher current at the wave reduction approaching to that obtained on titanium substrate.

Keywords: silicon electrodeposition, Non-aqueous solvent, amorphous silicon, amalgamated copper electrode, phenyltrichlorosilane, Quaternary ammonium salt.

1. INTRODUCTION

Amorphous silicon is a semiconductor material displaying optical and electronic properties highly favorable to photoconductive and photovoltaic applications; these favorable properties have been generally attributed to the presence of an appropriate content of hydrogen within the film. Thus, Amorphous silicon (a-si) is a promising new material for the fabrication of low cost large area solar cells of medium efficiency[1].It is usually made by glow discharge decomposition of silane[2], by thermal decomposition of silane[3] , by sputtering[4],or by sublimation of silicon[5].Such processes