Synthesis and technological application of electrodeposited semiconductors by EC-ALD

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Electrodeposition is known as a low-cost semiconductor growth technique for applications in electronic devices such as display and photovoltaic components [1]. Surface limited electrodeposition of metals and non-metals single-layers can be performed exploiting their underpotential deposition by EC-ALD (ElectroChemical Atomic Layer Deposition) technique to obtain calchogenide thin films [2]. The main advantage of this technique lies in the possibility of choosing the number of deposition cycles in order to perform an accurate control of the thickness and composition of the film, mainly valuable for the preparation of nanostructured materials. For this reason, a wide number of semiconductors in the form of thin films were obtained by EC-ALD. Initially the study was concerned with zinc and cadmium compounds, because of their suitable optical and electronic proprieties [3]. In particular cadmium calchogenides thin-films are used in manufacturing of last generation photovoltaic components. Toxicity and shortage of the involved elements must be considered in the advancement of technology. Hence scientific community is focusing attention on new compounds based on economic and low-environmental impact elements such as Cu, Sn, Fe, and Zn. In particular, quaternary semiconducting materials based on the kesterite (Cu_2SnZnS_4) mineral structure are the most promising candidates to overtake the current generation of light-absorbing materials for thin-film solar cells[4,5]. Another possible technological development that may involve EC-ALD technique is represented by the synthesis of nanostructures such as topological insulators (for instance bismuth calchogenides). These materials are of interest for the fabrication of devices in which surface state transport is dominant [6].

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