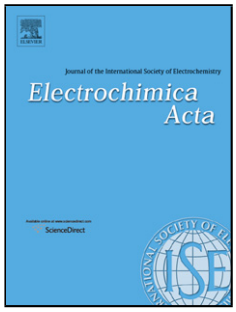

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Assessment on the use of the amorphous semiconductor theory for the analysis of oxide films

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Abstract

Although the theory of Schottky barrier in amorphous semiconductors is generally accepted, the limits of validity of such theory have not yet been explored. The classic semi-analytical solution is obtained under the constraint of constant electronic density of states (DOS) distribution in the mobility gap. In order to take into account the presence of a DOS variable in energy, a semi-empirical corrective power law was introduced in this paper. It is shown that the equations derived for thick films maintain their validity also in the case of thin films, provided that the space charge region width remains lower than 70% of the whole film thickness. A new expression based on the use of the series electrical resistance of a-SC/electrolyte junction is provided for calculating the DOS distribution within the mobility gap. A comparison between theoretical and experimental data is reported and discussed for thin anodic TiO_2/electrolyte junction.

Keywords: amorphous semiconductors; Schottky barrier; anodic oxides; electrochemical impedance spectroscopy; differential admittance.