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STUDY OF SOME ADDITIONAL POSSIBILITIES AND OF THE EVALUATION LIMITS OF THE DARK CURRENT SPECTROSCOPY (DCS) METHOD

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Abstract. *The basic goal of this work is to explore the possibilities and limits of the computational approach of the dark current spectroscopy method (DCS) to characterize the traps and impurities from the pixels of Charge Coupled Devices. In this aim, the experimentally measured dark current and their associated standard deviations for 8 temperatures and 20 randomly chosen pixels were studied starting from the rigorous quantum theoretical model of Shockley-Read-Hall. Besides the modulus |Et-Ei| of the difference of the trap and intrinsic Fermi level energies, the polarization degree (pdg) of the capture cross-sections of free electrons and holes, respectively, was defined by this work and used as a second uniqueness parameter intended to the traps identification. The proposed assignments of the |Et-Ei| and pdg numerical results to certain traps and impurities are based on the specialty literature data and on some special properties of the manganese complexes, particularly.*

Keywords: Charge Coupled Devices, Diffusion and Depletion Dark Current, Intrinsic Fermi level, Deep Traps Energies in Silicon, Capture Cross-Sections of electrons and holes

1. Introduction

As it is well-known, the main goal of the Dark Current Spectroscopy (DCS) is to characterize the impurities and/or defects present in the crystalline lattices of some semiconductor devices, as the Charge-Coupled Devices (CCDs) [1], [2], the semiconductor solar cells [3] etc., starting from the temperature dependence of their dark current. Taking into account the complex character of semi-conductors, they are described by a huge number of uniqueness parameters. In fact, the existing non-negligible measurement errors allow accurate evaluations only for few dominant uniqueness parameters, specific to the physical processes characteristic to a certain experimental method. For this reason, the achievement of some sufficiently complete physical characterizations of the impurities and/or defects of a semi-conductor lattice requires the use of two or more complementary measurement methods.

Or, the systematic study of the implications of the measurement errors on the characterization possibilities of impurities and/or defects of each experimental method, hence of its limits, is un-fortunately practically completely missing.

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