ELECTRON IRRADIATION FACILITY FOR THE STUDY OF RADIATION DAMAGE IN LARGE SOLAR CELL ARRAYS IN THE ENERGY RANGE 0.5 < E ≤ 5 MEV.

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Electron beams with energies in the MeV range are used in research and industry to develop new materials and to change the physical and chemical properties of materials of technological interest (e.g. polymeric materials or semiconductors). These beams are also used to study the effects of space ionizing radiation in solar cell power modules[1)] found in spacecraft and satellites. However, most of the facilities that are traditionally used to study radiation damage in solar cells can only produce beams with a spatial homogeneity of a few cm^2, thereby limiting the size of the samples to be irradiated. In this work, a description is presented of an industrial irradiation facility where large samples (of the order of m^2) can be uniformly irradiated. At this facility, a dc accelerator produces electron beams with energies between 0.7 and 5 MeV, and currents ranging from hundreds of microamps to tens of milliamps. Large area irradiations are achieved by continuously scanning the electron beam back and forth in one dimension, while the sample either remains static or moves in the transverse direction at speeds of the order of tens of cm/s, by means of a linear motion system (LMS) designed in house. Both the FC and the LMS will be described.

The physical and chemical effects produced by the electron beam are a function of the dose absorbed by the material and, therefore, of the fluence of the incoming radiation. Measurement of absorbed dose is performed with a variety of dosimeters. Measurement of electron beam fluence is performed with a Faraday Cup that was designed to be used at this facility. The FC was designed to be used at low and high powers, and to take into account the penetration of high energy electrons. A data acquisition system was developed via a "virtual instrument" using LabVIEW[2)] and nuclear instrumentation modules (NIM). Examples of fluence measurements on semiconductor devices will be presented.

1) A. Holmes-Siedle, L. Adams, "Handbook of Radiation Effects", Ch. 6 Diodes, solar cells, and optoelectronics, Oxford University Press, Oxford, UK 1993.

2) LabVIEW Full Development System, National Instruments, 11500 N MO PAC Expy., Austin TX, 78759, USA.

TOPICS + KEYWORDS: Electron Beam, Faraday Cup, Electron Fluence, Solar Cells, Radiation Damage.

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