Characterization on Proton/Electron Irradiated Cu(In, Ga)Se_2 Thin-Film Solar Cells by Impedance Spectroscopy

(P)Tzu-Ying Lin [1,*], Ishwor Khatri [2], Takahiko Yashiro [1], Tokio Nakada[2], Mutsumi Sugiyama[1,2]

Faculty of Science and Technology, Tokyo University of Science, Japan[1]

Research Institute for Science and Technology, Tokyo University of Science, Japan[2]

E-mail: shelleylin08@hotmail.com

Proton/electron radiation has been used to test the stability of several materials and diode-like devices for space applications. Cu(In,Ga)Se_2 (CIGS) thin film solar cells have shown its high radiation resistance due to the self-healing effect *via* environmental temperature or light illumination.[1,2] The influence from energetic charged particles of the thin-film solar cells is usually evaluated by the remaining factors of photovoltaic parameters, such as open-circuit voltage (V_{oc}), current density (J_{sc}), fill factor (FF) and efficiency and power. However, the mechanism of irradiation-induced defects enhancing recombination and recovery between proton and electron irradiation is still not clear. In addition, for a complex multilayered thin-film solar cell, the degradation mechanism still lacks direct detection techniques to distinguish the radiation damage at different interfaces. Herein, in this work we propose an electrical characterization to analyze proton/electron irradiated CIGS thin-film solar cells using impedance spectroscopy. Through the different response of impedance spectra after the proton/electron irradiation, we can further distinguish the bombardment effect from proton and electron on the space charge region or even other interfaces.

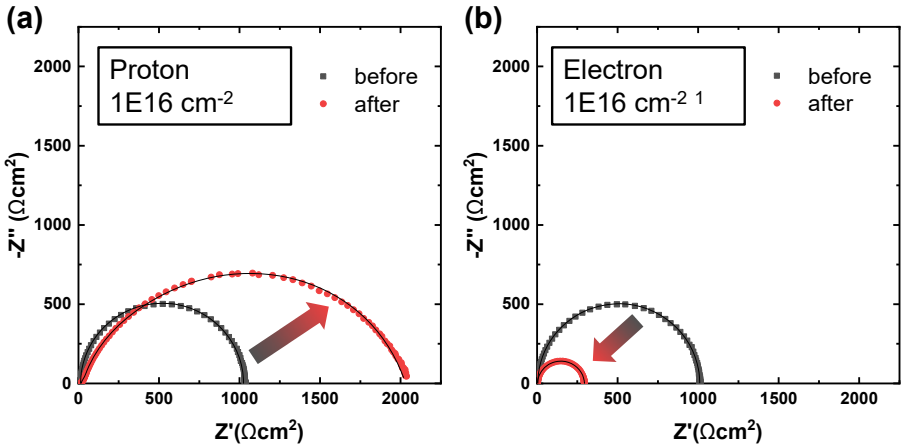

Figure 1. Nyquist plots for CIGS thin film solar cells before and after (a) proton (380keV, 1E15 cm^{-2}) and (b) electron (2MeV, 1E16 cm^{-2}) irradiation.

1. A. Khan et al., *Jpn. J. Appl. Phys.*, **41**, L797–L799 (2002).
2. A. Jasenek, U.Rau, K.Weinert, H. W.Schock, and. H.Warner, in *Conference Record of the Twenty-Ninth IEEE Photovoltaic Specialists Conference, 2002*, pp. 872–875, IEEE (2002).