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Electron-induced degradation of J-V characteristics of GaInP top cell and GaAs middle cell by electroluminescence measurements

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Electroluminescence (EL) measurements were carried out to investigate the irradiation effects of 1.0 MeV electrons on the current density-voltage (J-V) characteristics of the GaInP top cell and GaAs middle cell of GaInP/GaAs/Ge triple-junction solar cells at injection current densities ranging from 2.5 mA/cm² to 30 mA/cm². By utilizing the optoelectronic reciprocity relation between the EL and external quantum efficiency (EQE), the dark J-V characteristics of the two subcells were derived, as well as the short-circuit current density and the open circuit voltages. It is shown that the short circuit current density and the open circuit voltage of the top cell and the middle cell both degrade with the increasing fluence, but that of the middle cell degrade more than the top cell at the same fluence. Meanwhile, The current-limiting cell changes from GaInP top cell to the GaAs middle cell. The GaAs middle cell contributes to more loss in voltage of the 3J solar cell.

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