Effect of Temperature on Shunt Resistance of PV Modules during Potential Induced Degradation Recovery Test

◦Kiyoshiro Takada[1], Htay Win[1], Yudai Kawaguchi[1], Aster Rahayu[1], Fumitaka Ohashi[1], Hiroki Yoshida[1], Atsushi Masuda[2], Shuichi Nonomura[1]

[1]Gifu University, Japan, [2]National Institute of Advanced Industrial Science and Technology, Japan

E-mail: w3915101@edu.gifu-u.ac.jp

Potential induced degradation (PID) has attracted much attention in recent years since it brings drastic decreasing in output power of photovoltaic (PV) modules. The recovery process of PID of PV modules by applying the reversed bias voltage has been widely discussed. Recently, we developed a technique to induce the PID recovery by applying a reverse bias square pulse to the PV modules. In this study, we investigated the effect of temperature on the shunt resistance of PV modules during PID recovery test.

PV modules were fabricated by vacuum lamination of p-type c-Si cell (15.6 x 15.6 cm), cover glass, ethylene-vinyl acetate (EVA) encapsulant and back-sheet. A copper mesh was attached on the PV modules as an electrode for PID test with the conditions of -1000 V, 85°C and duration of 90 min. The PID recovery test was carried out by repeating application of the reverse bias square pulse with the conditions of 10 V, 1 A and 1 s from the room temperature to 100°C until the recovery of shunt resistances was saturated. The humidity was not controlled during both PID and PID recovery tests. Each measurement of the shunt resistance was conducted after cooling the PV modules to 25°C during the PID recovery test.

Figure 1 shows the shunt resistance after PID test and PID recovery test. The value was normalized with the shunt resistance before PID test. It was found that the normalized shunt resistance during the PID recovery test increases with the temperature applied to the PV modules and is saturated at the value before PID test. It was considered that the migration of sodium ions occurred toward the p-type Si across the p-n junction by the applied reverse voltage and was enhanced due to the thermal energy (heating) applied to the PV modules during PID recovery test.

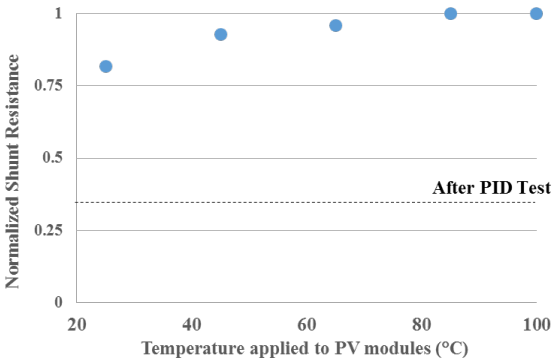

Figure 1. Normalized shunt resistance with temperature applied to PV modules during PID recovery test.

Acknowledgement:

This research was conducted as a part of New Energy and Industrial Technology Development Organization (NEDO) Project.