

Performance Diagnosis Method for Vehicle-Mounted PV Panels

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Photovoltaic-integrated electric vehicles (PVEVs) are expected to play a significant role in promoting the adoption of renewable energy in the transportation sector. As PVEVs and other vehicle-mounted PV systems become more widespread, there will be an increasing need for simple and accurate methods to evaluate the performance of onboard PV panels, in order to detect faults, assess degradation, and estimate appropriate replacement timing, for example during periodic vehicle inspections. In this context, we are developing a performance diagnosis method based on so-called electroluminescence (EL) using a PVEV vehicle that we own (Fig.1). In this presentation, we report our initial results and discuss the feasibility and challenges of the proposed method for real-world vehicle inspection scenarios.



Fig.1 AIST's PVEV

Figure 2a shows an example of EL images acquired from our PVEV. In order to quantitatively evaluate these EL images, the EL intensity values were extracted from each pixel, and histograms were constructed as shown in Fig. 2b. By comparing the shift in the peak position of the Gaussian fitting curves, we tracked changes in the EL intensity of the vehicle-mounted PV system. Since EL intensity is known to be correlated with the quality and performance of PV panels (particularly for crystalline silicon-based panels), we attempted to relate the observed EL intensity variation to changes in PV performance. According to our initial trial, a 22% decrease in the EL intensity peak was found to correspond to an approximately 0.27% decrease in the nominal output capacity of the PV system.

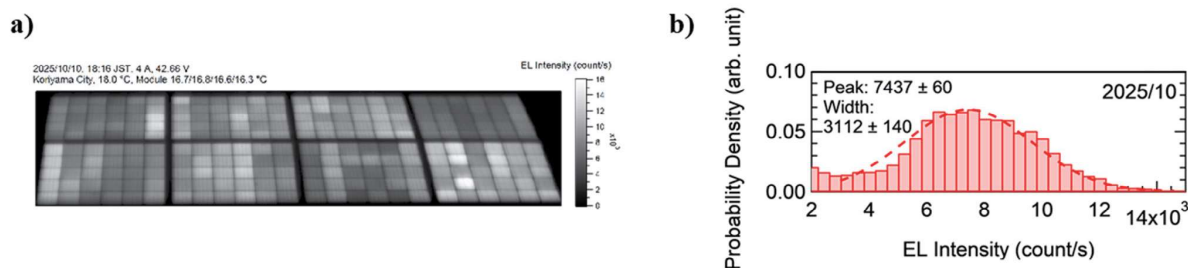


Fig.2a) Example of EL images, b) Histogram of EL intensity of Fig.2a.