

Recent status of the battery energy storage technologies in Japan and issues related with performance evaluation

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Abstract

In Japan, the introduction of the renewable energy power supply including photovoltaic power generation and the wind-generated electricity increases rapidly after the Great East Japan Earthquake of 2011. FIT system and various subsidy systems of the government become the fair wind of the renewable energy introduction. Because of the large fluctuation of the output power of the renewable energy resources, the stabilization measures of the electric power system are necessary. Therefore the application of the various electrical energy storage technologies to supply-demand balance control or frequency adjustment control is considered.

The battery energy storage systems are most popular in the electrical energy storage technologies. The battery does not have harmful exhaust and is the low noise. Then, there is little setting limitation of battery, so that we can install the battery in the near electricity consumption area in short term of works. Because recent technology development greatly advanced, as for the lithium ion battery in particular, the construction of the large-capacity battery system was enabled. Therefore, some electric power companies start verification projects of the large-scale battery system utilizing the subsidy of the government.

The examination item by the verification projects of the battery system is mainly the construction and the improvement of the control technology for stabilization of the electric power systems. On the other hand, there are still few examples of the large-scale battery system, so that a performance evaluation of the present battery system is also important. The performance evaluation items include charge/discharge energy, power, efficiency, life-time, and safety. Especially, establishment of the life estimate technique from short-term test data becomes the important issue, however the life-time evaluation of the battery system needs the data accumulation by the long-term test in the present.

We performed a life evaluation of the lithium ion battery after the 1990s while participating in the national projects in Japan. We accumulated the life-time test data by various conditions such as charge/discharge pattern, the range of state of charge, the temperature and so on. In addition, since about 10 years ago, we have been disassembled the batteries which show performance decrement and try elucidation of the deterioration mechanism from the analyses of electrode-materials. Furthermore, for a life estimate of the lithium ion battery of a battery system during actual operation, we develop the nondestructive deterioration evaluation technology by detailed analysis of the battery voltage and the battery temperature with charge/discharge.