Research of Battery Diagnosis and Management Technology for Battery Energy Storage System

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Abstract

Renewable energy often includes solar and wind energy generated from sources depending hugely on weather conditions, thus makes the power generation fluctuate dynamically. As such renewable energy becomes prominent in a power grid system, electricity storage systems can be applied as a solution to ensure power supply stability. Meanwhile, these storage systems can achieve power peak shift by charging redundant electricity during night, and discharging them during daytime in which power consumption reaches its peak. Batteries are suitable for electricity storage systems due to their ease of use. Lithium-ion batteries, which have recently been attracting attention for use in electric vehicles (EV), tend to become practical because of their compactness and simplicity.

As Lithium-ion battery is a high energy density device involving risk of explosion hazard, it needs highly functional Battery Management System (BMS) to monitor each cell's voltage, temperature and current and to manage the battery status.

The State of Charge (SOC) and the State of Health (SOH) are the key performance indexes for battery management. SOC can be calculated by current integration, however, a long term measurement may lead to a considerable amount of integrated error. Generally, the error can be compensated using open circuit voltages vs SOC characteristics. However, the open circuit voltage characteristic of LiFePO4 is relatively flat in the range of usage, making it difficult for battery energy storage systems to perform such calibration. On the other hand, SOH is defined by the cell capacity degradation. Generally, measurement of SOH takes considerable amount of time, since full discharge and charge is required. This paper explains the technology of the SOC/SOH diagnosis which can be performed within short time while maintaining high measurement accuracy. The paper also explains applications in actual battery energy storage system such as cell balancing and management.