

# Characterization Techniques in the Field of the Solar Energy Storage Device

V. Jayaweera, S. Kaneko, K. Murakami

*SPD Laboratory, Shizuoka University, Hamamatsu, Japan*  
*Email: viraj@spd-lab.com, virajjayaweera@gmail.com*

## Abstract

Energy storage devices, such as batteries and supercapacitors play important role in both solar and wind energy applications. Amount of electrical energy produced by the solar cell directly depends on the incident amount of sunlight and only work in the daytime. Wind energy production depends on the available speed of the wind. Usually, the peaks of energy production and consumption times are different in a day. Therefore, storage of energy is essential for non-grid-tied solar and wind energy systems. Thousands of research groups have been working on battery and supercapacitor development to invent a storage device with the highest possible energy density. Almost all researchers are spending more than half of their valuable time for measuring their samples and plotting graphs. In this study, we have developed an instrument and control software to automate characterization procedure of supercapacitor and battery. This instrument will allow researchers to focus on their material development work rather than spending most of the time for characterization work. This newly developed instrument is capable of measuring capacitance, energy density, internal resistance, leakage current and plotting all the stranded curves, such as charge-discharge, cyclic voltammetry, and self-discharge individually. The heart of the instrument consists of computer controllable power source and electronic load with potentiostat / galvanostat capability. It can charge and discharge capacitors up to 8 amperes of constant currents and up to 20 volts. The working principle of this instrument based on high power operational amplifier with two error-amplifies in the feedback loop to limit the current and voltage to given values. This work will discuss the working principle of the newly developed characterizing instrument and how it helps to resolve challenges researches faced during supercapacitor and battery characterization.