ABSTRACT

Lithium ion (Li-ion) batteries play an important role in energy storage, user safety, and lifetime in daily activities. One of the commonly used batteries is $LiFePO_4$ batteries used for electric vehicles, but these Li-ion batteries will become waste after being damaged. The purpose of this research is to understand the correlation of electrical properties and material structure of the Li-ion battery cathode as a basis for the development of recycle batteries. The scope of this research includes analyzing the electrical properties of $LiFePO_4$ battery samples A, B, C, and D with different treatments, namely 800 Watt 2.5 Ohm and 1000 Watt 0.005 Ohm loading for 1 cycle, 30 cycles, and 100 cycles respectively. And explain the crystal structure of the results of different treatments. With XRD technique to observe the crystal structure and SEM to produce high-resolution images of the $LiFePO_4$ surface with 3 kinds of magnification, namely 2500x (50 μm), 5000x (30 μm), and 10000x (10 μm). The results of this study show that the more cycles experienced by $LiFePO_4$ batteries will affect the battery charge and discharge times, and the electrical properties are also affected by this treatment, such as the battery capacity value, SOC value, and battery SOH. However, this study also found that there were no significant changes to the minimum-maximum voltage and current values. The SOC and SOH values have a tendency to decrease in performance the more cycles are performed. For samples A and D, the average values of SOC and SOH are 97.060%, 107.11% and 8.024%, 11.72%, respectively. The linear regression values of SOC and SOH for samples A and D are 88.23+0.595x, 105.90+0.023x, and 19.44-0.563x, 15.18-0.0518x, respectively. The RMSE values of SOC and SOH are 23.89, 44.74, and 15.48, 9.11, respectively. As for the XRD results, it shows amorphization that appears along with the number of cycles, as well as SEM results that show agglomeration formed when more cycles are applied.

Keywords: LiFePO4 Battery, Electrical Properties, X-Ray Diffraction (XRD), and Scanning Electron Microscopy (SEM).