

The Analysis Of Capabilities At The Ex-Laptop 18650 Lithium Ion Battery

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ABSTRACT

The lithium ion battery has Lots used in device electronics, including laptops. However, as time goes by, the performance battery can decrease. Battery the often thrown away and become a problem environment Because own substances are dangerous and challenging to unravel. A more environmentally friendly and economical choice if we can reuse it in various projects. This study aims to The Analysis of Capabilities at The Ex-Laptop 18650 Lithium Ion Battery. This research method is descriptive research, namely carrying out current investigations that solve existing problems, namely carrying out observations, data collection and measurements on 18650 lithium-ion batteries. The results measuring the highest battery capacity are 2.015 AH, and the lowest battery capacity is 0.031 AH with an average capacity of 1.063 AH. In contrast, the internal resistance is 16 mΩ to 125 mΩ, with an average of 41.55 mΩ. Lithium-ion 18650 batteries used for laptops experience a decrease in capacity and resistance in use and recharge cycles, contributing to battery capacity degradation.

1. Introduction

The battery is something cell electrochemical changes energy chemistry into electricity (Dickson, 2020). The type of battery currently being developed is the Lithium-Ion Battery. Component Component The main components that form a Lithium-Ion battery viz electrode negative (anode), electrode positive (cathode), electrolyte and separator. Lithium-Ion Battery is a type of rechargeable secondary current source battery. At this time, Lithium -Ion Battery is a battery that is needed, among others, to use its electrical energy in cell phones, mp3 players and others. In addition, currently, Lithium -Ion Batteries are necessary for electric motorbikes and electric cars (Fatahilla et al., 2017).

The well-known 18650 lithium-ion battery with density energy is very tall and small in physical size and has advantage of charging repeat very well (Kurniawan, 2020). Although the battery usually has an age-long enough wear, every charging and discharging period can result in a declining capacity battery.

With internal use for a long time, the lithium-ion battery 18650 entered several affecting changes ability (Suhaimi et al., 2020). Causative factors include period charging and emptying many times, exposure to which temperature is extreme, and frequent use Can make degradation in the ability of the battery (Najihah et al., 2019). Moment laptop batteries already do not have good performance or experience declining capacity, the battery is often discarded, creating a problem environment because its substances are dangerous and challenging to unravel. But there is more choice, friendly environmental and economical rather than throwing away a used 18650 battery. We can use it to return on various projects you need to supply Power portable. When we do this, we contribute to coping with waste electronics and help guard the environment.

From the explanation above, the researcher is interested in The Analysis of Capabilities at The Ex-Laptop 18650 Lithium Ion Battery, which include voltage, capacity, and internal resistance. Obtaining the data from this study can provide better

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information about the quality and performance of used batteries. Furthermore, it can be used for various purposes, including; portable power banks, flashlights, solar lights and more.

2. Literature Reviews

2.1 Batteries

The battery is a source of energy that can change energy stored chemicals into energy electricity that can be used on electronic devices. Almost whole devices, portable electronics, including laptops, cell phones, and remote control, batteries as sources of electricity. Because a battery exists, we do not need to connect cable electricity to thanks so that turn on the electronic device and quickly bring it everywhere. The battery consists of the positive terminal (Cathode), negative terminal (Anode), and a working electrolyte as delivery. (Anto et al., 2014). Current output electricity from the battery is present in the same direction or also called DC (Direct Current) (Mundus et al., 2019).

2.2 Lithium Ion battery

Li-ion battery is a battery that can be removable (Muhammad Otong, Didik Aribowo, 2019). Battery type This we usually encounter on laptops, tablets and smartphones. This Li-Ion battery refers to the material course, where the truth is: There are lots of Li-ion batteries with a compound and different chemistry. (Farida Antika, 2019)

Based on the chemical compounds used in Li-ion batteries, these batteries are divided into six groups or types: (1) Li-ion batteries that use the chemical compound LiCoO_2 (Lithium Cobalt Oxide) or abbreviated as LCO. (2) Li-ion battery using Lithium chemical compound Manganese Oxide (LiMn_2O_4) or abbreviated as LMO. (3) Li-ion battery using Lithium chemical compound Nickel Manganese Cobalt Oxide (LiNiMnCoO_2) or abbreviated as NMC. (4) Li-ion batteries that use Lithium chemical compounds iron Phosphate (LiFePO_4) or LFP for short. (5) Li-ion batteries that use Lithium chemical compounds Nickel Cobalt Aluminum Oxide (LiNiCoAlO_2) or abbreviated as NCA. (6) Li-ion batteries that use Lithium chemical compounds Titanate ($\text{Li}_4\text{Ti}_5\text{O}_{12}$) or LTO for short (Wikipedia, 2018).

2.3 18650 Lithium Ion Battery

Lithium-ion battery 18650 usually have specification as follows; Dimensions The 18650 lithium-ion battery is approximately 18 mm in diameter and high about 65mm (Cara, 2020). That's why it pinned "18650" in the type battery. The nominal voltage of a 18650 lithium-ion battery ranges from 3.6 volts up to 3.7 volts (Wiguna et al., 2021). But when fully charged, the voltage can reach about 4.2 volts. Capacity 18650 lithium-ion battery range between 1500 mAh up to 3500mAh (Anshori et al., 2020). Capacity shows how much energy the battery can store and affect how long the battery can be used. The lifetime of the 18650 lithium-ion battery has a limited time and can experience degradation over time usage. The battery has cycle charging and emptying between 300 to 500 times (Faqih et al., 2021). The safety of the 18650 lithium-ion battery is equipped with circuit protection to avoid excess current, high temperature, and unstable voltage. It helps to look after security moments using the battery. (Fatimah et al., 2020).



Figure 1. Used Laptop 18650 lithium-ion battery

The 18650 lithium-ion battery has many advantages over other types of batteries, including higher capacity, more comprehensive temperature range, durability and being environmentally friendly. However, 18650 lithium-ion batteries also have some drawbacks, including a higher price and the possibility of exploding if not used properly. (Dewanto, 2021).

3. Methodology

3.1 Type Study

This research is descriptive, namely carrying out investigations that solve existing problems at present, namely carrying out observations, data collection, and measurements on 18650 lithium-ion batteries. The descriptive method is intended to

describe the nature of something ongoing when the research was carried out and look at the causes of specific symptoms. This is done by collecting data and facts according to actual conditions (Sutopo, AH; Arief, 2010).

3.2 Methods and Tools Data Collection

Implementation of data collection with the method separates the battery from the laptop battery casing, then codes by assigning a number to the battery and taking measurements of the 18650 lithium-ion battery. Measurement of the 18650 lithium-ion battery uses Lithokala Lii-500 to get the voltage, capacity, and internal resistance, as shown in Figure 2 below:



Figure 2. Measurement using lithokala Lii-500

3.2.1 Equipment used

Equipment used to take data collection:

- 1) Multimeters
- 2) Laptops
- 3) Lithokala Lii-500 and
- 4) Other supporting equipment.

3.2.2 Tool Installation

The necessary step is installing four 18650 lithium-ion batteries into the Lii-500 lithocal meter slot. With method connect battery terminals in the four available battery slots. In the second stage, choose the Nor Test mode, where the battery capacity testing mode is considered the most accurate but takes the longest time. Because the battery will be charged first until it's complete, drained until it runs out, then charged again until it's full, the battery capacity is displayed. The third stage is selecting the available current charging mode, which is 500 mA. Testing is done by taking battery voltage data, battery capacity, and resistance in the battery. After collecting all sample data, start drafting the report, as shown in Figure 3.

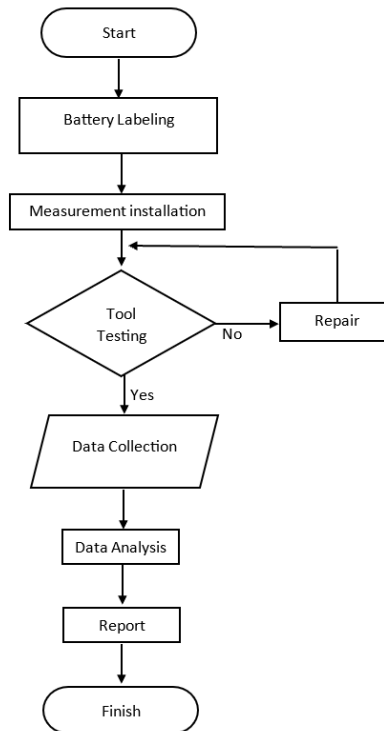


Figure 3. Research Flow

3.3 Data Analysis Method

Data that has been obtained from observation and measurement in a manner directly analyzed. As for technique processing, the data is as follows:

1. Data on battery voltage, battery capacity, and resistance in the battery were measured once for 20 the ex-laptop 18650 lithium ion battery
2. Data from voltage battery, capacity battery, and resistance in battery, then conclusions about the ex-laptop 18650 lithium ion battery capacity were obtained.
3. Describing the results measurement of the battery voltage, battery capacity, and internal battery resistance in tabular form and graph.

4. Results and Discussion

4.1 Results

Measurement of the battery voltage, battery capacity, and resistance in these batteries was carried out using the Litokala Lii-500, which is displayed in digital form and can be seen in the table 1.

Table 1. Measurement results of the 18650 lithium -ion battery

Battery Code	Volt	AH	i (mR)
1	4,2	0.807	31
2	4,19	0.13	16
3	4,19	0.546	28
4	4,19	2.015	21
5	4,2	0.462	68
6	4,19	0,745	50
7	4,19	0,031	125
8	3,98	1,971	79
9	3,91	1,239	27

Battery Code	Volt	AH	i (mR)
10	4,19	1,396	37
11	3,93	1,169	42
12	4,18	1,389	27
13	3,61	1,872	22
14	4,2	1,307	28
15	4,19	1.373	39
16	4,2	1.145	35
17	4.01	0.207	51
18	4,2	1.229	35
19	4,2	1,721	30
20	4,2	0.497	40
Average	4,118	1,063	41.55

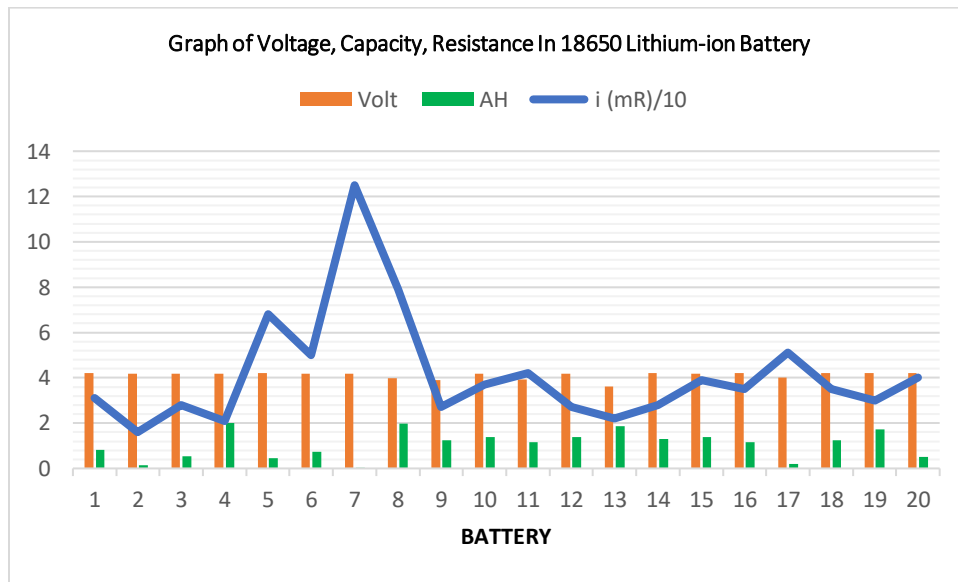


Figure 4. Graph of Voltage, Capacity and Resistance in 18650 Lithium-ion Battery

4.2 Discussions

The measurement results show that used laptop batteries experience a decreased capacity, battery use, and age. Factors such as recharge cycles and changes in electrode materials can cause capacity degradation. This may affect battery life and limit the usage time of the device. It can be seen from the measurement results of the highest battery capacity of 2.015 AH and the lowest battery capacity of 0.031 AH. With an average capacity of 1.063 AH.

Repeated charging cycles can cause degradation of the electrode material, especially at the cathode layer. The test results show a decrease in capacity along with the number of recharge cycles. In some cases, the capacity loss can be up to 15% after 100 cycles.

Internal resistance measurements show that some used laptop batteries have a higher internal resistance. High internal resistance can result in increased heat during battery charging and discharging and reduce the efficiency of the energy that

can be stored and released by the battery. It can be seen from the results of internal resistance measurements from 16 mΩ to 125 mΩ, with an average of 41.55 mΩ.

The results of this test can help and provide information to consumers in selecting the appropriate battery, then replacing the battery that has been degraded. By paying attention to capacity and internal resistance, consumers can choose a battery that has better performance and extends the life of their device.

5. Conclusion

The measurement results show that the used laptop lithium-ion 18650 battery declined internal capacity and resistance along with the use and age battery. The cycle of repeated recharges also contributes to the degradation capacity battery. From the measurement results, the highest battery capacity is 2.015 AH and the lowest battery capacity is 0.031 AH, with an average capacity of 1.063 AH. At the same time, the internal resistance is 16 mΩ to 125 mΩ, with an average of 41.55 mΩ.

Proper care to maintain battery performance is by regularly recharging and maintaining optimal battery temperature to extend battery life. In addition, the results of this study provide insights for developing better battery technologies in the future, focusing on more durable electrode materials and optimizing the recharge cycle.

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