Renewable Energy Storage Innovation of Air Batteries Using Steel Anodes

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Air batteries are an emerging technology for renewable energy storage. Their distinct chemical properties convert atmospheric oxygen into viable electric energy. Currently, air batteries are not widely used due to their low efficiency, low lifespan, high cost, and harmful byproduct production. The objective of this innovative project is to investigate the modifications in air battery design to make them more cost-effective and eco-conscious in addition to increasing the efficiency, and lifespan in order to use in renewable energy storage. After conducting experiments with aluminum, zinc, magnesium, iron, and steel alloy, steel alloy was proven to be the most suitable metal to construct the anode of the air battery. In the experiment, steel alloy was used in the form of paper clips composed of 99% iron and 0.06% carbon with a protective steel layer preventing corrosion. Due to steel alloy's chemical properties, it yielded a theoretical discharge duration of 100-hours with a 10-hour recharge time while surviving for nearly 10,000 discharge/recharge cycles and an experimental energy density of 13,700 Wh/kg. Due to the low cost of the materials used to modify the battery, 1 kWh cost only $1.14 making the steel alloy air battery 100 times cheaper compared to currently used lithium-ion batteries. In addition, the inclusion of a trace amount of nickel powder in the electrolyte and the cathode reduced the possibility of harmful byproduct production in addition to increasing the efficiency. This project resulted in a novel design of an air battery capable of storing renewable energy in a cost-effective and eco-conscious manner.

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