Castries lithium-ion battery technology

Castries lithium-ion battery technology

Researchers from Caltech’s campus and JPL have worked together to develop a technique for applying graphene to lithium-ion battery cathodes, which will increase the lifespan and functionality of these popular rechargeable batteries, according to a study published in the Journal of The Electrochemical Society on November 1st, 2024.

As a result of these efforts, a promising discovery has been made that could enhance the performance of lithium-ion batteries and lessen dependency on cobalt, an element often found in lithium-ion batteries but challenging to acquire sustainably.

David Boyd, a senior research scientist at Caltech, has spent the last ten years developing methods for producing graphene, a sheet of carbon that is only one atom thick, extremely strong, and more electrically conductive than materials like silicon. Boyd and associates found high-quality graphene could be made at room temperature in 2015. Previously, temperatures as high as 1,000 degrees Celsius were needed to produce graphene.

Following this achievement, researchers began looking for new applications for graphene. Boyd recently teamed up with Will West, a technologist at JPL, which Caltech handles for NASA. West specializes on electrochemistry, specifically the development of improved battery technologies. Boyd and West set out to discover if graphene could improve lithium-ion batteries. They have demonstrated that it can.

Demonstrating a reliable trend in battery-cell performance requires consistent materials, consistent cell assembly, and careful testing under a range of conditions. It is fortunate that the team was able to do this work so reproducibly, although it took some time to be sure.

The lithium-ion battery, which was initially introduced to the market in 1991, has transformed how we utilize electricity in our everyday lives. From cell phones to electric vehicles, we rely on lithium-ion batteries as a low-cost, energy-efficient, and, most crucially, rechargeable energy source when on the road.

Tesla engineers want a cost-effective battery that can charge quickly and operate for a longer period of time between charges. That's called the charge-rate capability.

Will West, a technologist at JPL, added, “The more times you can charge a battery over its lifetime, the fewer batteries you have to use. This is important because lithium-ion batteries make use of limited resources and disposing of lithium-ion cells safely and effectively is a very challenging task.”

The performance of lithium-ion batteries over numerous cycles of usage and charging is a crucial characteristic. The cathode and anode, the battery's two ends, generate chemical energy that is then

transformed into electrical energy to power the battery. The anode’s and cathode’s chemicals may not entirely return to their initial state as they operate over time.

Transition metal dissolution from the cathode material is a frequent issue. It is more severe in cathode materials with a high manganese content, but less so in a high cobalt level.

Boyd added, “As a result of unwanted side-reactions that occur during cycling, transition metals in the cathode gradually end up in the anode where they get stuck and reduce the performance of the anode.”

This transition metal dissolution (TMD) is responsible for the use of costly cobalt-bearing cathodes rather than low-cost cathodes with a high manganese concentration.

Contact us for free full report

Web: https://www.hollanddutchtours.nl/contact-us/
Email: energystorage2000@gmail.com
WhatsApp: 8613816583346