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X-ray Views of Batteries' Interiors

ZSW assesses battery damages with 3D HD scanner

As lithium-ion cells for electric cars, e-bikes and energy storage make inroads into the market, the ability to analyze aging and defective batteries is becoming increasingly important. In cases of damage, such assessments often aim to determine what caused the impairment-improper use, manufacturing defects or design flaws. To conduct these examinations, the Centre for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW) now has a dual-source X-ray scanner that peers deep into batteries' inner workings. It delivers high-definition images to enable nondestructive failure assessment. Europe's renowned battery research institute has again expanded its range of services with this new device.

The CT scanner is some 2.5 meters long, 1.60 meters wide and stands 2 meters tall. It will serve dual purposes, for both post-mortem analysis in cases of damage and to assure the quality of new products. With the benefit of insights gained with this scanner, manufacturers will be able to target specific problem areas and improve materials as well as electrode and cell manufacturing methods. The machine will also support the institute's efforts to develop new testing methods for the battery industry.

Battery scanner affords views into micro structures

Two tubes provide penetrating insight into the internal structure of batteries and their components. The 300 kilovolts (kV) micro-focus tube is especially well suited for scanning larger cells and entire battery modules. Details down to the size of 1 micron can be captured with this 300-kV tube. Able to obtain images as miniscule as 0.5 microns - that's half a thousandth of a millimeter - the nano-focus tube is even more powerful.

"We can now see the smallest anomalies and structural changes within the cell in three dimensions," says Prof. Werner Tillmetz, a member of ZSW's board of directors and head of the Electrochemical Energy Technologies division. "This enables us to gain crucial insights for optimizing cells and production processes." The electrochemical 'patients' are fixed in place on a precision rotating sample tray to be scanned by either tube. A rotation may range up to 50 centimeters in diameter and the samples may be up to 80 centimeters tall. The ability to accommodate such large samples is an important prerequisite for investigating battery modules.

Zentrum für Sonnenenergie-
und Wasserstoff-Forschung
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Experience runs deep at ZSW

The scientists at the Ulm-based institute know batteries inside and out. With over 600 cell openings to date, they have earned a reputation for excellence in post-mortem analysis. They have the skills and tools needed to investigate every type, from conventional lead acid and lithium batteries to the latest super caps, and every cell format - round, pouch and prismatic-designed for up to 400 ampere hours. The institute conducts post-mortems on batteries used in many different applications ranging from electric cars, solar power storage and mobile phones to tablet computers, navigation systems and e-bikes.

A specialist with over twenty years experience in battery research and certified by the German Federal Association of Technical Trade Experts (BDSH) is responsible for damage assessment at ZSW.

The Centre for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW) is one of the leading institutes for applied research in the fields of photovoltaic energy, renewable fuels, battery technology, fuel cells and energy systems analysis. The three ZSW sites at Stuttgart, Ulm and Widderstall are currently staffed with around 230 scientists, engineers and technicians supported by 70 research and student assistants.

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Pictures and a fact sheet on ZSW is available from:
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The new dual-source X-ray scanner at ZSW. Photo: ZSW/Duckek



3D-CT image of a Lithium-ion battery for electric cars (PHEV-1 cell design). Photo: ZSW