

## Technical paper

Quality assurance of battery modules  
with ZEISS VoluMax 9 titan



**ZEISS eMobility Solutions**



Seeing beyond

# Quality solutions for battery modules

Battery modules must function flawlessly in order to ensure the necessary level of operational safety and reliability. It is therefore essential for manufacturers to characterize the microscopic structure, chemical composition, and electrical properties of the materials used. Battery samples are to be scanned and assessed in a manner that protects them against exposure to the air, and quality microscopy solutions must pinpoint the potential for battery failure by generating detailed visualizations of the material microstructure. The detection of foreign particles measuring 5  $\mu\text{m}$  and over is also critical for preventing contamination.

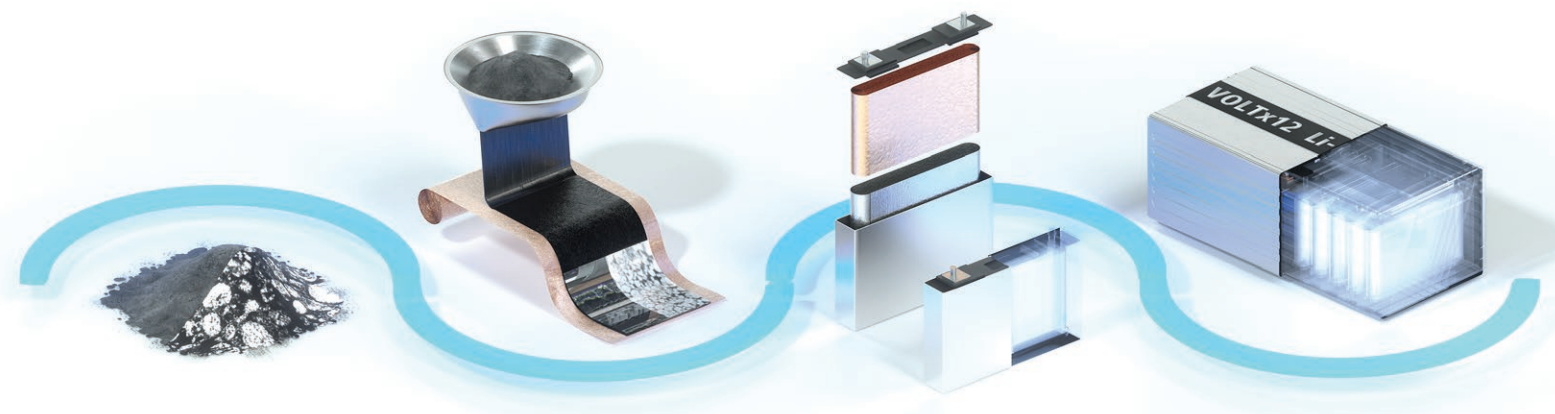
A particular challenge is posed by the non-destructive checks performed on finished cells and modules, since only X-ray technology with sufficiently high penetration strength can provide clear and swift detection of any internal defects. You can rely on

a great set of quality assurance solutions for all different stages of battery development and production. For the last part – the module assembly – the ZEISS VoluMax 9 titan offers great penetration power making sure that no defects are overlooked.

## From material to finished product

Your product must prove its quality in various ways during the battery production process – and versatile tailored quality solutions from ZEISS are ready for deployment at every step of the production chain.

- **Material development**  
for the cathode, anode, and separator
- **Structure development**  
for assembly and creation of the battery cell
- **Raw material processing**  
for morphology visualization
- **Electrode production**  
for cleanliness and burr inspection
- **Cell production**  
for inspection of internal defects
- **Module assembly**  
for handling dense structures

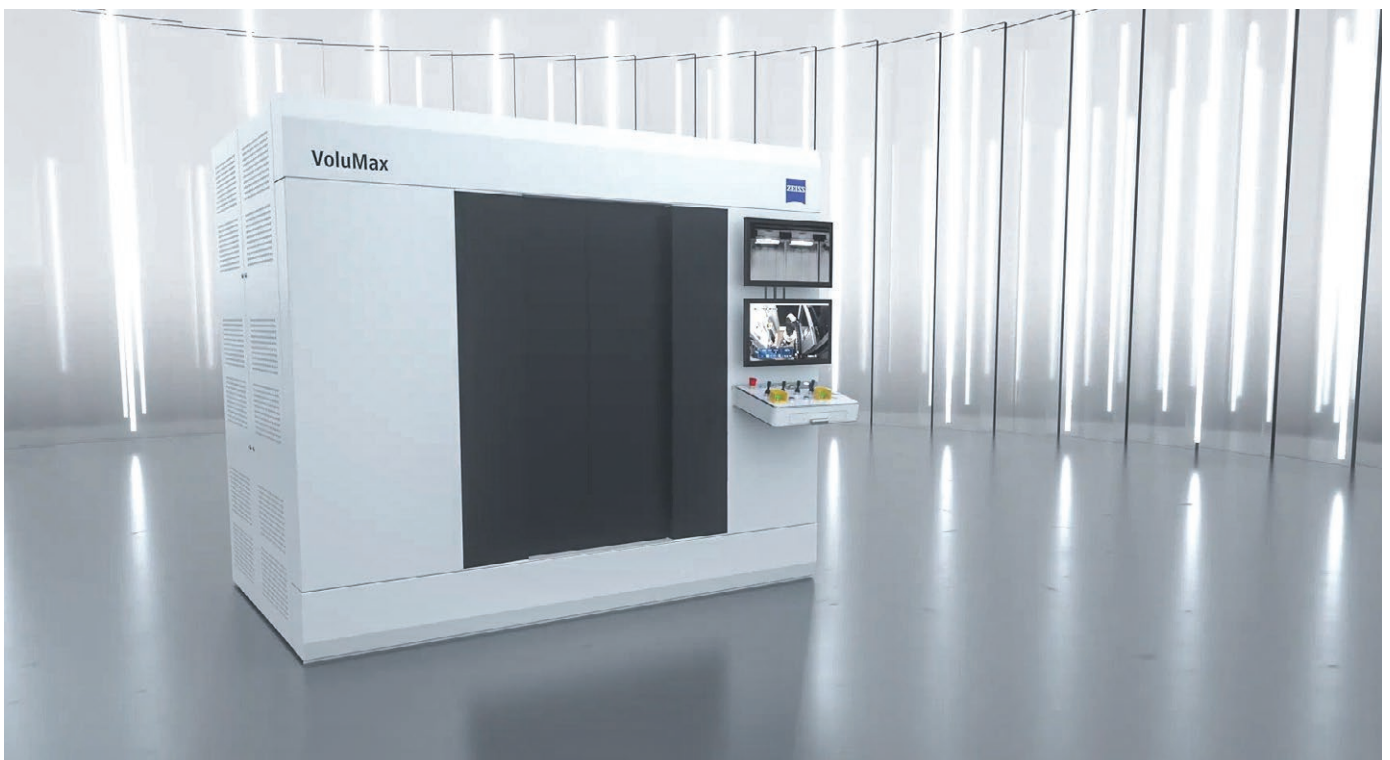


# Battery modules: Non-destructive inspection on a whole new scale

**In the face of developments such as the shift toward electric vehicles, battery modules are becoming ever more crucial for manufacturers to avoid being left behind. With this increasing focus comes an expanding set of demands, not least in terms of quality assurance at the conclusion of the battery production process. The inspection must be performed in a non-destructive manner using high-performance X-ray technology. Yet the solutions offering the penetration strength necessary for handling entire battery modules have to date been bulky and heavy units that take up large amounts of valuable space. ZEISS has responded by launching VoluMax 9 titan, the most compact and robust 450 kV system available. Suited to quality lab and at-line environments alike, this cost-effective CT powerhouse sets new standards in its class and is ideal for reliably capturing large dense parts measuring up to 590 x 700 mm and weighing as much as 60 kg.**

Sophisticated quality assurance throughout every step of the process is key to being a serious player on the battery market. When inspecting the finished product, typical defects including metal contamination and electrode misalignment demand reliable detection – and the use of non-destructive X-ray systems to preserve the part. Yet not only do battery modules have very different requirements to individual cells in terms of critical safety aspects such as welding and overhang, they are also far more dense since they are packed with an increasing number of electronic components. Manufacturers therefore need the perfect blend of accuracy and performance, which is where the ZEISS VoluMax 9 titan comes in.

Boasting the smallest footprint of any machine in the 450 kV class, it nevertheless packs quite a punch. This remarkably robust and surprisingly compact powerhouse delivers the high power and voltage needed to penetrate large modules, helping manufacturers consistently obtain accurate and reliable results as well as fast cycle times. Assembled from top-quality components, equipped with a 3k detector for high-resolution inspection, and backed up by 24/7 service from ZEISS, it boosts productivity while minimizing downtime for a terrifically fast return on investment.



*ZEISS VoluMax 9 titan is the most robust and compact system in the 450 kV class*

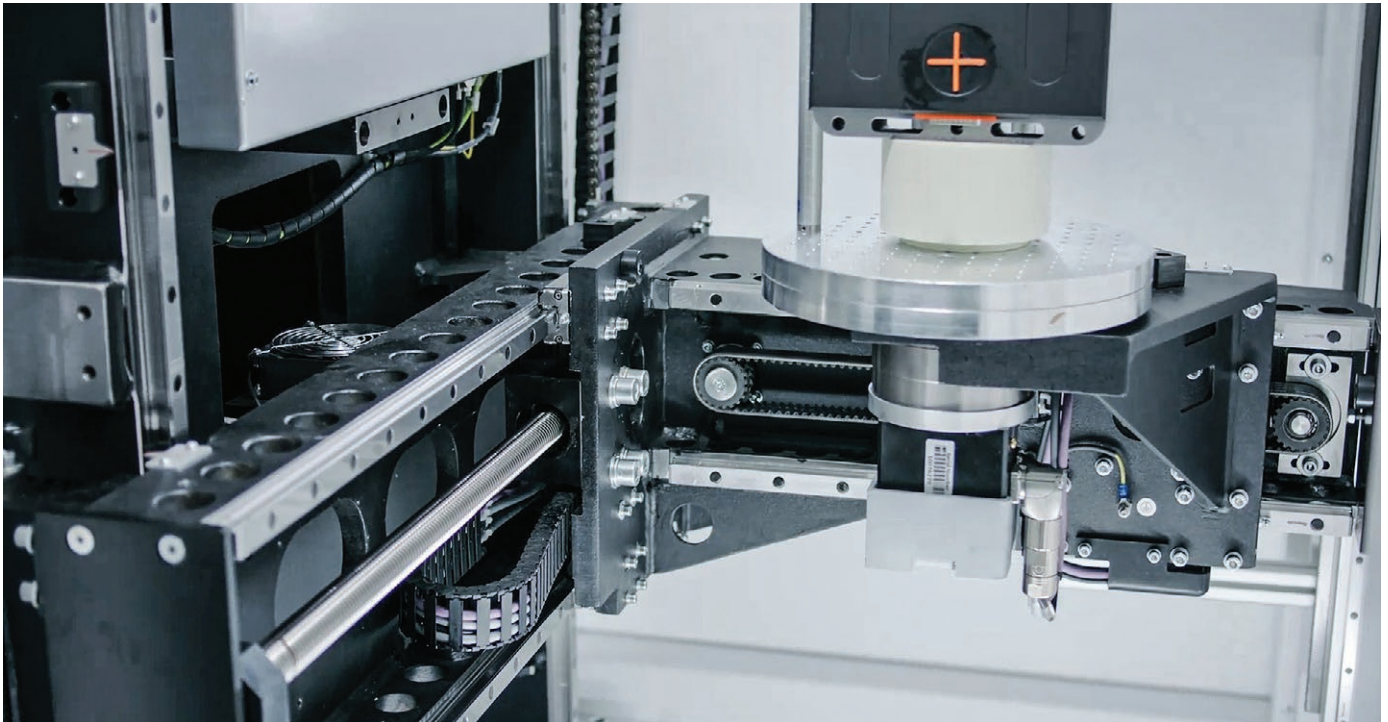
## Meeting the extra challenges posed by battery modules

The core task to be met by CT solutions in this context is the accurate, clear, and swift identification of internal defects in the assembled cell. In detecting these flaws, which range from metal contamination to folded electrodes, manufacturers can reduce waste and eliminate potential safety hazards. But when many cells are grouped together in a battery module, the demands relating to defect inspection grow more complex and challenging.

Not only are such modules significantly larger than cells, often measuring hundreds of millimeters in height, they are also far

heavier and can weigh in excess of 50 kg. And unlike individual cells, these modules feature large quantities of dense materials such as copper, steel screws, and PCBs – all of which must be reliably penetrated by sufficiently powerful scan technology. Finally, these checks must be coordinated with short cycle times so as to avoid disruption and maintain streamlined processes.

Read on to discover just how the compact and robust ZEISS VoluMax 9 titan helps you meet each of these challenges in turn and take your inspection efficiency to new heights.



*Battery module being scanned inside the ZEISS VoluMax 9 titan*

## Unbeatably compact, unmistakably robust

Thanks to its 450 kV tube voltage and 1,500 W of power, the ZEISS VoluMax 9 titan delivers the superlative penetration strength required for handling dense battery modules while enabling the fast scanning that is vital to operational efficiency. All of this is underpinned by high-quality components tested to withstand demanding environments: The mover and generators in this system are even developed and manufactured in-house at ZEISS.

What truly sets the ZEISS VoluMax 9 titan apart is the unique way in which it marries this robust performance with compact design. Though its dimensions of 2,750 x 2,350 x 1,750 mm are the tightest in its class, it is an extremely spacious system capable of scanning parts as large as 590 x 700 mm and as heavy as 60 kg. While comparable competitor products can easily fill an entire room, the ZEISS VoluMax 9 titan weighs a mere 13,500 kg and has all the feel of a normal workstation.

This impression is reinforced by the control panel being integrated into the cabinet, thus saving space as no additional

table is required. Users can view guaranteed high-resolution scans captured by the 3k detector, which excels at detecting smaller defects, and enjoy support from a wide range of ZEISS software solutions for crystal-clear analysis. The smart sizing and positioning of the mover system makes it much safer and easier to load heavy parts into the machine.



*Integrated control panel saves space and boosts usability*

## Ergonomic operation and holistic service

Operators are treated to a series of ergonomic benefits that boost ease of use – for instance, the system is more convenient to transport and install as the high-voltage generator and cooling unit are located inside the cabinet. Part loading is also made more straightforward by the wide sliding doors, which offer generous access and are positioned very close to the manipulator. Furthermore, you can place your foot on the system itself for safe and secure handling during loading.

ZEISS offers a whole host of excellent hardware and software services that keep the maintenance requirement low. Whenever support is needed, teams of native-speaker service technicians and trainers are ready for swift deployment in some 25 countries.

The ZEISS VoluMax 9 titan promises a speedy return on investment, as its commitment to exacting quality standards,

numerous components in common with other systems, and compatibility with fast cycle times help supercharge productivity. This uniquely compact yet remarkably robust package consistently adds value throughout your inspection process.



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