Anton Paar

– CUSTOMER SUCCESS STORY –

Münster Electrochemical Energy Technology (MEET) at the University of Münster, Germany

Analytics – MEET Battery Research

Along the entire value chain in battery research, the Münster Electrochemical Energy Technology (MEET) Battery Research Center at the University of Münster relies on sample preparation from Anton Paar.

From developing new materials and producing battery cells, to recycling old batteries, Anton Paar's Multiwave 7000 microwave digestion instrument makes a valuable contribution to MEET's battery research.

Relevant for:
Analytics, Battery, Recycling, Research & Development, Universities

Multiwave 7000

Full Analytical Bandwidth in Battery Research

With around 150 employees, MEET, at the University of Münster, is one of the leading centers of German battery research. Along with developing sustainable and high-performance storage materials for electromobility, the center also focuses on optimizing renewable energy usage.

MEET is active in every area of battery research, including the development of new materials for energy storage, in-house cell manufacturing, and recycling old batteries. The main areas of focus are lithium-ion technology and promising, new, solid-state batteries.

In analytics, the composition of the individual materials across the entire battery value cycle is key. That's why the "Analytics & Environment" department at MEET isn't just researching the composition of the various battery components, it's also exploring the reactions that occur, and other mechanisms.

Detailed knowledge of the elemental composition of the various electrode materials provides valuable insights into the life cycle of a battery – from raw materials and manufacturing to life-cycle analysis and recycling. A particular challenge for Dr. Sascha Nowak, head of the "Analytics & Environment" department at MEET, is the complex composition of batteries and the wide variety of analytical methods.

Samples range from very corrosion-resistant anode materials, such as graphite, to reactive mixed oxides that contain lithium, nickel, cobalt, and manganese as cathode materials.

For optimal analysis, Dr. Sascha Nowak relies on wet chemical sample preparation by microwave digestion, elemental analysis, and other surface analysis methods.

“We can completey break down graphite anodes,” says Dr. Sascha Nowak enthusiastically.

Using Multiwave 7000

Any analysis is only as good as the sample preparation that precedes it. Multiwave 7000 enables optimal, individual digestion for the respective analytical problem. Due to the special design of the device, temperatures up to a maximum of 300 °C and a pressure of up to a maximum of 199 bar can be reached. This makes the digestion of all kinds of samples possible.

Since reference materials are relatively scarce in the field of battery analysis, the total content of the elements is made accessible for analysis via prior microwave digestion. Particularly with samples made of and containing graphite, whose matrix is especially resistant, digestion presents a special challenge. Anton Paar offers a powerful solution here with Multiwave 7000. Due to the high temperatures that Multiwave 7000 can reach, the graphite matrix can be broken down more easily.

Batteries “Back to the Future”

In the last 15 years, a lot has happened in the battery material development and recycing field. Due to this, analytics is also facing new challenges. That's why Anton Paar works closely with research institutes to jointly develop promising solutions in sample preparation directly in the analytical environment.

"Lithium batteries will still be the main actors in the near future. Of course, there will also be a lot going on in their further development," says Dr. Sascha Nowak. According to Nowak, "New cathode materials will be richer in nickel in order to reduce cobalt content. To reduce the burning hazard of solid-state batteries, attempts will be made to do without liquid components. These are interesting tasks for us."

In second-life applications and old battery component recycling, the analytical inspection of the incoming batteries that are to be recycled also plays a central role, since it provides information about the type of battery and the materials used.

Anton Paar's microwave digestion instruments are constantly evolving. The innovative technology makes it possible to optimally digest even challenging samples with intuitive and simple operation. Since these methods can easily be used in new devices, Anton Paar offers future-proof solutions by optimally combining proven knowledge and new technologies.

Efficiency Increase and Method Transfer Made Easy

For more than 20 years, MEET has relied on microwave digestion equipment from Anton Paar. The center started with Multiwave 3000, and then it started using Multiwave Pro. Now MEET is working with the Multiwave 7000 generation enabling digestion of a wide variety of samples in the same run.

The switch and method transfer from old, rotor-based microwave digestion equipment to Multiwave 7000, which uses pressure-sealed vessels in a pressurized digestion cavity (PDC), took only about two to three days. After that, routine operation could continue.

> *"There is still a long and challenging road ahead before new materials and technologies are truly usable. New materials that are now classified as promising substances at the university may not find application for another 10 years," says Dr. Sascha Nowak.*

Various batteries

Since Multiwave 7000 makes it possible to combine a wide variety of sample types in one digestion, MEET has been able to significantly increase its efficiency since it started using Multiwave 7000 – for sample preparation, in particular. Since all sample types can be digested in the same run, there is no need to group samples, which significantly reduces preparation time and increases sample throughput.

"Employees are thrilled with how easy and convenient it is to use the jars when preparing samples," Dr. Novak said.

As a manufacturer of microwave resolution devices, particulary with Multiwave 7000, Anton Paar is making a significant contribution to advancing research at the MEET Battery Research Center in Münster and setting the course for a more sustainable and environmentally friendly future.

The most important points at a glance

OPERATION:	Microwave-assisted acid digestion for sample preparation for elemental analysis
SAMPLES:	Batteries and their respective components
INSTRUMENTS:	Multiwave 7000 with Rack 18 (previously Multiwave Pro and Multiwave 3000)
SAMPLE THROUGHPUT:	60 samples per week