



Micromobility battery life cycle: challenges and opportunities

The case for recovering lithium-ion batteries



Empowering Trust[®]

Battery and energy storage systems have distinct public and product safety concerns.

Our testing and certification services and expertise help you understand how your products will perform under anticipated usage and various hazardous scenarios — including abuse — during discharge and recharge cycles.

With the increase in use of lithium-ion (li-ion) batteries comes an increase in demand for the raw materials used in manufacturing and increased disposal of used batteries. By one estimate, China alone will generate over 500,000 metric tons of used li-ion batteries in 2020 and the worldwide number will be over 2 million metric tons.¹

Many sustainability considerations around the life cycle of li-ion batteries must be taken into account: from environmental and social considerations during mining to potential impacts during disposal. For example, Congo is the world's largest producer of cobalt, producing approximately 70% of the world supply.³ Most cobalt is mined as a byproduct of copper or nickel in larger mines although artisanal mining still is a production path. As recently as 2019, cobalt was involved in a lawsuit alleging child labor used in mining in Congo.⁴

Many of the potential social and environmental emissions issues can be avoided by recycling cobalt. While current technologies for battery recycling have carbon emissions similar to using virgin material, new technologies are coming online that can significantly reduce carbon emissions.

Several valuable raw materials in li-ion batteries can be recovered, including nickel and cobalt, which as of July 2020 traded at around \$6 and \$14 per pound respectively.²



Safety issues during recovery

While recycling li-ion batteries has many benefits, it also has potential safety hazards. Inherent to li-ion chemistries currently in use is the risk of fire from the stored energy in the battery. But the fire risk can be avoided in several ways. First is recycling only a completely discharged battery. If the battery is no longer charged, the energy required to start a fire from a short circuit or puncture is missing and the battery is much less likely to catch on fire. Second is to properly manage the battery at end of life, recycling rather than disposing in general waste. Multiple incidents have been reported in which a charged li-ion battery was placed in general waste and has caused a fire when compressed in a truck or damaged on the sorting floor, according to a story from the Washington Post, research from the Fire Safety Journal and an article from Fire Rescue1 by Lexipol.⁵ Proper disposal, sorting and recycling of batteries is critical to the safety of municipal recycling systems.

Our commitment to advancing battery safety science

We have been supporting the battery industry for more than 30 years. During this period, batteries evolved into different end applications, chemistries, sizes, shapes and energy densities. As a part of our public safety mission, we conduct research into battery safety to provide better understanding of batteries, their safety profiles, material attributes and failure mechanisms. Expansion of battery usage into micromobility products in recent years has brought additional challenges in battery safety, performance, environmental impact and recycling.

You can leverage our services to test and certify products according to UL Standards and applicable global, national and regional standards and requirements. These include the United Nations (UN) requirements for lithium battery transportation testing, as detailed in the UN Manual of Tests and Criteria, Sub-section 38.3 (UN 38.3, UN International Air Transport Association (IATA), U.S. Department of Transportation (DOT)).

Our comprehensive solution for batteries and micromobility manufacturers, distributors, retailers, users and others include:

- Safety testing and certification of batteries and end products
- Electromagnetic compatibility (EMC) and radio performance testing
- Advisory and training solutions
- Research testing
- Component safety testing and certification
- Global Market Access solutions
- Performance testing and claims validation
- Functional safety evaluations
- Forensic analysis
- Environmental sustainability solutions
- Ongoing compliance of supply chain and manufacturing control



Powering progress across the battery value chain

Our services cover the entire value chain of the energy storage industry. From suppliers, manufacturers and system integrators, to insurers, shippers, retailers and consumers, we transform decades of experience and expertise into tangible assistance. Here are some of the overarching services on which our customers depend.

Safety

We offer safety compliance testing, inspection and certification for accessing and achieving differentiation in global markets. For the past 30 years, we have been a leader in safety testing and certification for battery technology and we have wide experience in providing those solutions in multiple locations globally, to various standards, including the International Electrotechnical Commission (IEC), European Standards (EN), UL Standards and many others.

This is important because a recent study done by the European Commission found that 80% of the personal transporter products they evaluated were not in compliance with requirements. The product-specific activity of personal transporters was analyzed in 46 samples of electric bikes, electric scooters, hoverboards and uni-wheels. The main hazards found included:

- Risks of fire or explosion when charging electrical personal transporters
- When using hoverboards under the rain or on wet surfaces, there is a risk of sudden electrical failure, if the electric system gets wet⁶

Performance

Our performance testing is available across the value chain, from competitive benchmarking for materials to charge/discharge and overcharge tests for cell and battery pack manufacturers as well as environmental and altitude simulation for system integrators. We also offer UL performance certification Marks for battery products compliant to relevant IEC/ EN standards.

UN/DOT Compliance

UN/DOT 38.3 is an international standard designed to help ensure the safety of lithium batteries when transported. We have multiple testing laboratories across the globe to demonstrate compliance with UN/DOT 38.3.

Sustainability

UL Environmental Claim Validation (ECV) provides manufacturers with credibility for their environmental sustainability claims, such as battery recycling programs. Validated products are featured on our publicly available UL SPOT Sustainable Product Database.

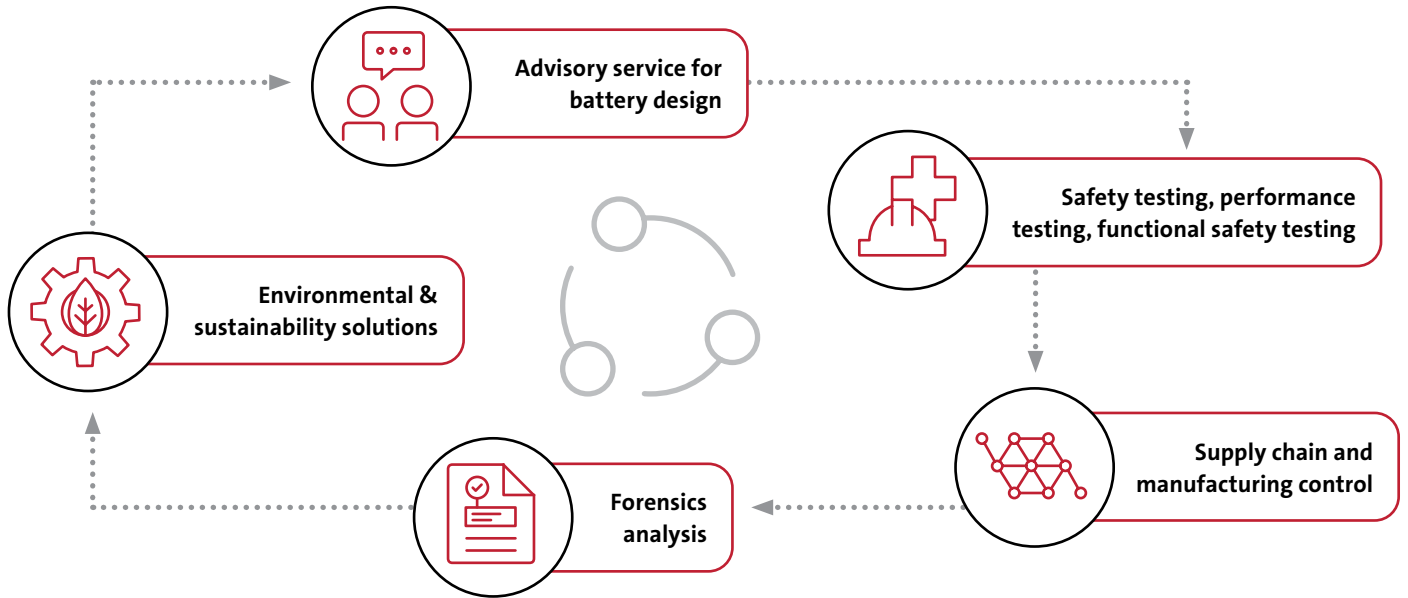
Transparency

Companies with effective and responsible supply chain management systems gain competitive advantages for their brand. Our experts offer a range of services to help companies identify and track potential conflict minerals in their supply chain, supporting increased customer loyalty and corporate profitability.

Market incidents

An appropriate response to market incidents caused by batteries and micromobility products requires a deep knowledge of technology and scientific analysis of evidence and root causes. Our forensic analysis solutions, led by our technical experts utilizing scientific methods and equipment, help our customers identify quality, design and usage issues; establish a benchmark for future designs; and set up proper criteria and requirements for their products.

Complete lifecycle support



Endnotes

1. <https://cen.acs.org/materials/energy-storage/time-serious-recycling-lithium/97/i28>
2. <https://www.dailymetalprice.com/metalprices.php> - accessed 6/16/20
3. USGS National Mineral Information Center – Cobalt Statistics and Information 2020 Mineral Commodity Summaries - <https://www.usgs.gov/centers/nmic/cobalt-statistics-and-information>
4. <https://www.bbc.com/news/world-africa-50812616>
5. <https://www.washingtonpost.com/technology/2018/09/11/explosive-problem-with-recycling-ipads-iphones-other-gadgets-they-literally-catch-fire/>
6. https://ec.europa.eu/consumers/consumers_safety/safety_products/rapex/alerts/?event=casp:persTrans

References

- Ragni Fjellgaard Mikalsen, Anders Lönnermark, Karin Glansberg, Margaret McNamee, Karolina Storesund, "Fires in waste facilities: Challenges and solutions from a Scandinavian perspective", Fire Safety Journal, 2020, 103023, <https://doi.org/10.1016/j.firesaf.2020.103023>
- <https://www.firerescue1.com/firefighter-safety/articles/batteries-cited-as-cause-of-wash-recycling-truck-fire-2QwHXB8EXlh1lmOy/>

To talk to us about your micromobility battery life cycle services needs, contact us at [UL.com/contact-us](https://www.ul.com/contact-us) or learn more at [UL.com/micromobility-devices](https://www.ul.com/micromobility-devices)



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