

Note: Below are extracts from an article published by The Financial Times (12th November 2023) as referenced below.

Tech start-ups race to make EV battery recycling sustainable.



The report from Olcott and Li (2023) explains how technology start-ups are investing millions in the more environmentally friendly recycling processes, using water-based technologies which are also perceived as a more commercially viable option:

Industry anticipates a surge in disposals as first batch of electric vehicles nears end of 10-year life cycle.

Technology start-ups are racing to make recycling electric-vehicle batteries cleaner and more economical, with investors pouring billions of dollars into recycling facilities globally to prepare for a surge in disposed packs and for regulations mandating minimum recycled content in new EV batteries.

With the first batch of electric cars nearing the end of their roughly 10-year lifespan, traditional recycling methods for lithium-ion batteries that power EVs are highly energy-intensive and involve burning used batteries at more than 1,400C. A clutch of start-ups, including Hong Kong's GRST and Oregon-based OnTo Technology, as well as larger companies such as German chemicals giant BASF, are working on a water-based technology seen as a commercially viable and environmentally friendly alternative.

"Lithium-ion batteries were not developed for recycling. The packs in EV cars are a nightmare," said Wojciech Mrozek, an expert on battery recycling at Newcastle University. "They are not unified and have foams and glue, which require huge manual labour to separate."

Water-based binders were "the future", he said, adding that they were "less environmentally aggressive" than their chemical counterparts and required "less aggressive methods to recover the metals". Global investment in battery-related start-ups this year — which reached \$9.2bn by September, according to Crunchbase data — is set to exceed the preceding two years, defying a broader downturn in tech investment. Battery-related start-ups collectively raised \$7.8bn in 2022, down from \$12bn in 2021.

Olcott and Li (2023)

Several Asian-based recycling companies, according to this Olcott and Li (2023) news article, are promoting this water-based technology over its chemical-based current alternative. Leaders in the field are hopeful of leasing the bespoke technology to other battery makers:

Most lithium-ion batteries use toxic chemicals to bind the metals to electrodes. The typical recycling method involves smelting discarded batteries or dissolving them in harsh chemicals to remove the binder and recover metals such as cobalt, nickel and copper as a metal alloy.

Under the process developed by Hong Kong's GRST, which is backed by the founder of Taiwanese chipmaker Realtek Semiconductor and Hong Kong garment behemoth TAL Apparel, the used batteries can be dissolved in water to obtain the so-called black mass of valuable metals that make up the cathodes and anodes.

GRST, a winner of this year's Earthshot prize for innovations to tackle climate challenges, hopes to raise \$50mn in the next two years to increase production at the battery plant it co-owns in Zhejiang province. In the long term, GRST hopes to lease its water-based binder and recycling technology to other battery makers.

Past attempts to commercialise water-based binders have failed because of poor battery performance. "In the past water-based solvents have not been as stable as chemical solvents," said GRST co-founder Justin Hung.

Studies have shown that water-based binders can cause corrosion but Hung said GRST had overcome this problem. Its batteries perform well in terms of energy density, safety and durability compared with chemical-based counterparts, according to its own customer tests.

Olcott and Li (2023)

Olcott and Li (2023) continues to outline the current situation with regard to the current recycling of EV batteries and how the environmentally friendly recycling of lithium-based batteries is not yet a priority for manufacturers:

OnTo Technology, a recycling start-up in Oregon, has started commercial tests of a water-based binder developed by scientists at Lawrence Berkeley National Laboratory. BASF invested in water-based binder production at two of its factories in China this year.

Experts said low recycling rates — less than 5 per cent of used lithium-ion batteries are recycled in the US — were a result of lack of investment and regulation. Most lithium-ion batteries are sent to waste management facilities or landfills, where the toxic chemicals in the binder can cause fires or leak into water systems.

"Recycling hasn't been a top priority for the industry so far. The existing technology for recycling lithium-ion batteries is not operational at scale," said Sarah Montgomery, co-founder, and chief executive of Infyos, a battery supply chain technology company.

Olcott and Li (2023)

How can we change the agenda for EV battery recycling? Well, the EU is leading the charge to regulate the area and set EV battery recycling rates for the next decade and Olcott and Li (2023) pinpoint regulation that is coming down the tracks for the industry and how companies can benefit:

But the tide was beginning to shift, according to Sarah Montgomery, pointing to regulatory changes spearheaded by the European Union to increase battery recycling rates and make the process more sustainable. In July, the European Council adopted the “battery passport”, which

will introduce a mandatory minimum level of recycled materials for EV and industrial batteries by 2031. The changes come as demand for batteries is rising in line with increasing use of electric vehicles. McKinsey analysts forecast that the value of the entire lithium-ion battery supply chain will increase annually by 30 per cent from 2022 to reach more than \$400bn by the end of the decade.

Analysts said companies such as GRST could benefit from alarm in western capitals about China’s dominance in the EV supply chain. More than three-quarters of the world’s lithium-ion batteries come from China, primarily made by CATL and BYD. “Europe in particular is heavily dependent on China. There is a strong push to become more self-sufficient by building a circular supply chain, going from relying on raw materials dug up from the ground to reusing spent batteries,” said Montgomery. “There is a tide of regulation coming in that will incentivise the recycling industry to develop.”

Olcott and Li (2023)

References

Olcott, E. and Li, G. (2023) ‘Tech start-ups race to make EV battery recycling sustainable’. *Financial Times November 12*. Hong Kong. Available at: Tech start-ups race to make EV battery recycling sustainable (ft.com) (Accessed 16 November 2023).