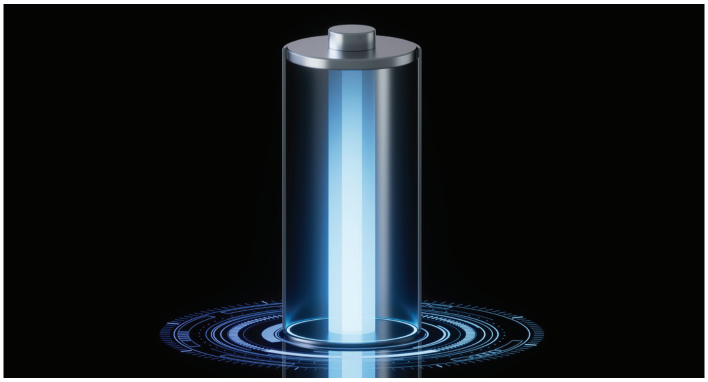
An electrifying passion for battery chemistry

A greener future depends on sustainable battery technology. Simon Engelke is driven to disrupt the status quo by challenging what we know about battery chemistry.

Simon Engelke, PhD had a fascination with alternative energy sources starting at a young age. “I got a hydrogen fuel cell toy car from my dad,” he began. “I was really inspired by tweaking with it.” A fuel cell toy and an inspirational chemistry teacher in high school became the basis for Simon’s current path – a career in battery technology.

Today, Simon is the founder and chair of **Battery Associates**, based in Dublin, Ireland. Battery Associates accelerates development and increases access to sustainable options in the global battery space.

All traditional electrochemical batteries are made of the same three basic components. **Anodes**, the negative electrode which releases electrons to the external circuit; **cathodes**, the positive electrode which accepts electrons from the external circuit; and **electrolytes**, the chemical medium through which ions flow between the anodes and cathodes.



When it comes to the electrodes Simon noted, “You have the cathode, and then you have the anode,” going on to add, “the cathode is the more expensive part.” This is partly because anodes are typically relatively simple – conductive and porous graphite or silica that accept and store ions from the electrolyte. Simon noted that cathodes are more diverse depending on the “different kind of battery chemistry.” Simon went into details for the two most commonly used lithium-ion chemistries – Nickel Manganese Cobalt (NMC), and **Lithium Iron Phosphate** (LFP) – and noted that even within these chemistries you can “do a lot of tweaks like reduce cobalt content and increase nickel content.” He noted that a change like this can, “increase energy density and reduce cost and sourcing challenges.”

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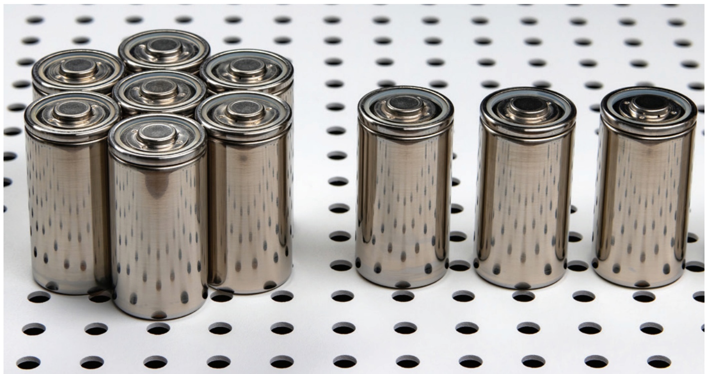

The place where Simon thinks much experimentation and expansion can happen is with electrolytes. Regarding this portion of the battery, responsible for transferring charge between the two electrodes, Simon noted, “You can play around as a chemist, have all kinds of fun combinations.” He explained that in lithium-ion batteries, it is lithium ions transferring charge through the electrolyte, which is typically lithium salts solvated using carbonates, esters or ethers. He noted that, “Lithium is quite attractive because it is very light and very small.” He went on to add, “you can store a lot of them, but there’s other ions like sodium, magnesium, and potassium.” In considering these non-lithium options Simon said, “You can look at what are all kinds of combinations, based on voltage differences.” Trying to improve electrolytes has been the focus of most of Simon’s research, “It’s just the tip of the iceberg, looking at a really nitty gritty component in the battery,” he asserted.

Battery chemistry is ever evolving with the development of new materials and technologies. “It’s fascinating because if you work with technology like this, you also keep competing against improving of the status quo,” On this topic Simon noted that solid state and other emerging technologies could deliver big improvements, but that existing chemistries, “are going to keep improving,” which constantly moves the bar for evaluation. By, “tweaking the graphite, the cathodes, using additives, and all these kind of fun bits,” Simon says that improvements to existing chemistries are, “maybe it’s not 20 percent a year, but maybe it’s like 3% or 5%.”

Current research in the industry is focused on improving battery components. For instance, **lithium iron phosphate** (LFP) battery chemistry has grown to become the dominant lithium-ion chemistry, replacing **lithium cobalt oxide** (LCO) batteries. This evolution of the market-dominant battery chemistry reflects the complexities of this field where chemistries change based on research as well as concerns over cost, safety, and the ethical sourcing of cobalt. “Cobalt is expensive,” Simon added, “and there are a lot of concerns with sourcing from, for example, the Democratic Republic of Congo.”

As for what the future holds for battery research, Simon believes that it is difficult to predict. “There are so many technologies and different approaches,” he stated. “Right now, I’m concerned about how we scale up what we already have,” he continued. He believes there will be continued demand for lithium-ion batteries, but it’s possible that other alternatives such as sodium-ion battery chemistries may gain market share as technology improves. “I will keep an open mind to what is coming,” Simon noted, going on to conclude with, “Being fascinated by chemistry and things, it’s like a massive playground for just testing things.”

For a deeper dive into Simon Engelke’s work, check out his interview on the ***Bringing Chemistry to Life*** podcast. There, we learn more about his education, career trajectory, and get into the “nitty gritty” of batteries and where battery chemistry research is headed.

Bringing Chemistry to Life
a **podcast** series

To listen to the podcast with Simon Engelke

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