THE NEXT-GENERATION LITHIUM-ION BATTERY

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ABSTRACT

Lithium-ion batteries are ubiquitous enablers of e-mobility and a principal component of many stationary energy storage systems. The quest to achieve this outcome commenced in 1975. These ground-breaking achievements led to the joint awarding of the 2019 Nobel Prize in Chemistry to Goodenough, Whittingham and Yoshino, who developed the first commercial lithium-ion battery.

Their research focused on various cathode types, of which two – ternary oxides and olivine structure phosphates – now dominate in batteries that power consumer products, electric vehicles and stationary energy storage applications in particular. The performance of lithium ferro phosphate ('LFP'), the most common olivine-structured cathode type, exceeds that of the more common ternary types but there is one shortfall: a comparatively lower energy density.

That said, the energy density of olivine-based cathode powders can be improved by the addition of transition metals; in particular, the addition of low-cost materials such as manganese, which results in lithium manganese ferro phosphate ('LMFP'). This has the potential to create a rapid development path for next-generation cathode materials.

Improvements in safety and energy density at cell level can also result from the use of different anode and electrolyte compositions. However, although perfecting combinations of components will no doubt herald a step change in cell performance, battery evolution is far more likely to be a gradual continuum influenced by sunk capital, which can lead to technical inertia, and intellectual property, which can restrict access to improved materials.

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