

FLASH BATTERY

# The next evolution of lithium batteries

AS LMFP CHEMISTRY APPROACHES INDUSTRIAL READINESS, FLASH BATTERY OUTLINES THE VALIDATION STEPS REQUIRED BEFORE THE TECHNOLOGY CAN BE DEPLOYED AT SCALE

▶ In the lithium battery sector, innovation rarely happens through sudden revolutions. More often, progress takes shape through incremental developments that enhance established technologies while preserving their strengths and reducing their limitations. This is the case of LMFP (Lithium Manganese Iron Phosphate), an emerging chemistry that is attracting attention in industrial applications.

According to Alan Pastorelli, co-founder and CTO, Flash Battery, LMFP represents a natural evolution of LFP (Lithium Iron Phosphate) chemistry, which is now widely used for its safety and reliability. "LMFP is not intended to completely replace LFP, but to extend its potential. Adding manganese to the lithium iron phosphate structure makes it possible to increase energy density while maintaining much of the set of advantages that have made LFP one of the most appreciated chemistries in industrial applications."

The increase in energy density can reach around 10%, offering OEMs greater flexibility where space and range are critical factors. This is a significant improvement, especially for electric vehicles and industrial machinery that require more energy without increasing weight or size.

## Managing trade-offs

However, like any technological evolution, LMFP also requires a balance between benefits and trade-offs. The increase in energy density leads to higher operating voltages and more complex electrochemical management. In addition, the introduction of manganese requires more sophisticated production processes to ensure long-term stability and reliability.

For this reason, LMFP has not spread earlier. Only recently have cell manufacturers and research centres reached a sufficient level of technological maturity to develop formulations capable of effectively managing the new electrochemical dynamics of manganese.

## Between LFP and NMC

From a performance perspective, LMFP exhibits characteristics that sit between LFP and NMC. Like NMC cells, it can reach charging voltages of up to



Flash Battery customised lithium batteries for industrial machines and vehicles

4.2V, contributing to increased energy density. At the same time, it retains some of LFP's typical flat voltage regions. This behaviour requires dedicated control logic and battery management system (BMS) algorithms designed to ensure accurate state of charge estimation and optimal battery management throughout the entire lifecycle.

## Validation process

For Flash Battery, the introduction of a new chemistry cannot be separated from a rigorous validation process. The company applies the same approach to LMFP as it does to any new technology intended for its customised solutions.

The first step involves verifying intrinsic safety through abuse tests, fault simulations, and thermal runaway analysis, to confirm the safety requirements that have made LFP an industrial standard. This is followed by cycling tests, thermal tests, and simulations based on real usage profiles, an essential phase for OEMs operating in sectors with intensive and continuous work cycles.

But the key step lies in the ability to industrialise innovation, bringing it into the field in a repeatable way. For this reason, Flash Battery considers the battery module a strategic element, capable of connecting cell-level innovation to industrial applications, ensuring scalability, quality, and production repeatability.

## Road to market

Today, LMFP cannot yet be considered a mass-market technology. The main cells available on the market are in the sampling or pre-series phase, and production volumes remain limited. For Flash Battery, the future of LMFP will depend on its ability to demonstrate safety, reliability, and concrete benefits for end users in real-world conditions. "Innovation means introducing new technologies only when they are truly ready to meet the demands of real industry," says Pastorelli.

A pragmatic approach to innovation that translates into precise engineering and industrial choices, and which will be fully showcased at Flash Battery's participation in the upcoming GSE Expo Europe 2026 in Lisbon, the leading event for the airport ground support equipment sector. From September 15-17, at booth E04, the company will present its custom lithium batteries for high-intensity airport applications and unveil the Flash Series, the new high-voltage modular platform developed to meet the growing electrification needs of the sector.

It will be an opportunity to demonstrate how chemical innovation, custom design, and industrialisation can converge into concrete, reliable solutions ready for the challenges of professional electric mobility. **ivT**

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