



Performance-Boosting Multifunctional Binder for Lithium Ion and Lithium Iron Phosphate Batteries

Tech ID: 33247 / UC Case 2023-848-0

BACKGROUND

Lithium-ion batteries are ubiquitous and their applications continue to grow. All of these batteries use binders to hold the electrode components together and retain contact with the active material hosting lithium ions. Polyvinylidene Fluoride (PVDF) is the most popular binder despite its negative environmental impact, and its performance capabilities leave much room for improvement. Environmental concerns are encouraging a departure from widely used nickel/cobalt-containing lithium-ion batteries (NMC/NCA), replacing the active material with lithium iron phosphate (LFP). Cost and environmental benefits aside, LFP batteries suffer from poor electronic conductivity and rate performance which currently limits them from replacing NMC/NCA lithium-ion batteries in high-power applications such as electric vehicles. A solution that would enhance the performance of both of these battery types could disrupt a \$45 Billion industry and set it on a more sustainable trajectory.

DESCRIPTION

Researchers at the University of California, Santa Barbara have developed a novel battery binder for Lithium Ion and Lithium Iron Phosphate batteries that dramatically improves their rate capability, cycle stability and lowers kinetic overpotential. The most popular conventional binder, PVDF, serves only to hold the electrode components together and is an insulator that prevents electron and ion transport. The key feature of this technology is the complex of two oppositely charged polyelectrolytes which, in addition to binding the key battery components together, also facilitates conductivity. While other multifunctional binders have emerged, they are incompatible with the industry-standard slurry casting process of fabricating electrodes and they require a non-conventional electrolyte. Furthermore, they require a tradeoff between ionic and electronic conductivity. This invention enables both electronic and ionic charge transport, does not dissolve in most battery electrolytes, and enhances battery performance enough to realize more sustainable next-gen technologies such as LFP batteries.

ADVANTAGES

- ▶ Multifunctional: maintains contact between electrode components and facilitates enhanced conductivity
- ▶ Enhanced rate capability, cycle stability, and lower kinetic overpotential
- ▶ Compatible with commonly-used slurry casting technique for fabricating electrodes

APPLICATIONS

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OTHER INFORMATION

KEYWORDS

Multifunctional Battery Binder,
Enhanced Rate Capability
Binder, Cycle Stability
Enhancer, Kinetic Overpotential
Reducer, Sustainable Lithium-
ion Binder, High-Performance
Battery Binder, Conductive
Polyelectrolyte Complex,
Electrode Slurry Casting
Binder, Eco-friendly Battery
Binder

CATEGORIZED AS

- ▶ **Energy**
 - ▶ Other
 - ▶ Storage/Battery
- ▶ **Materials & Chemicals**
 - ▶ Polymers

RELATED CASES

2023-848-0

- ▶ [Lithium Ion batteries](#)
- ▶ [Lithium Iron Phosphate batteries](#)

PATENT STATUS

Country	Type	Number	Dated	Case
Patent Cooperation Treaty	Published Application	WO 2024/098067	05/10/2024	2023-848

Additional Patent Pending

RELATED MATERIALS

- ▶ [A Coacervate-Based Mixed-Conducting Binder for High-Power, High-Energy Batteries](#) - 05/30/2023

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