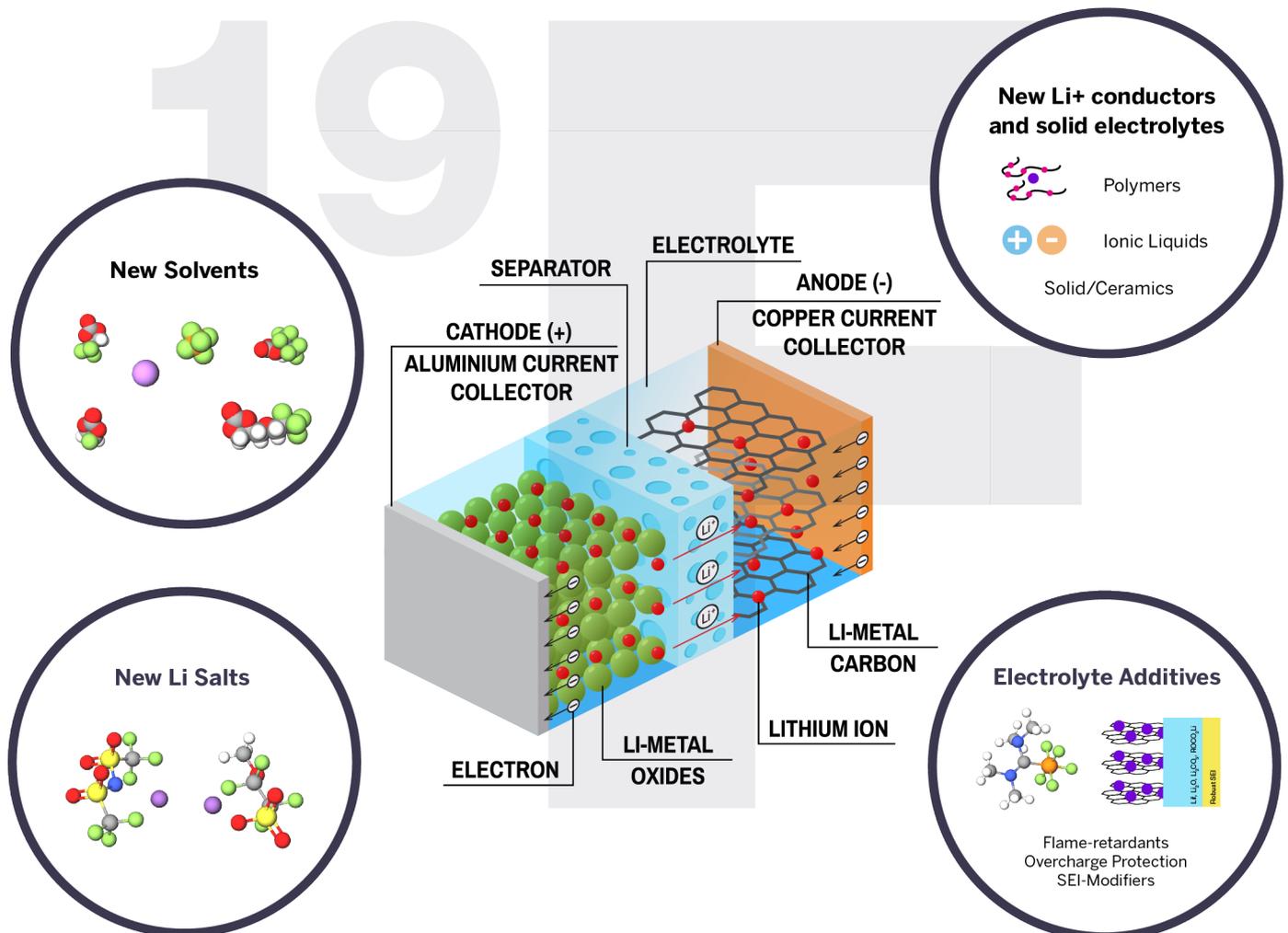
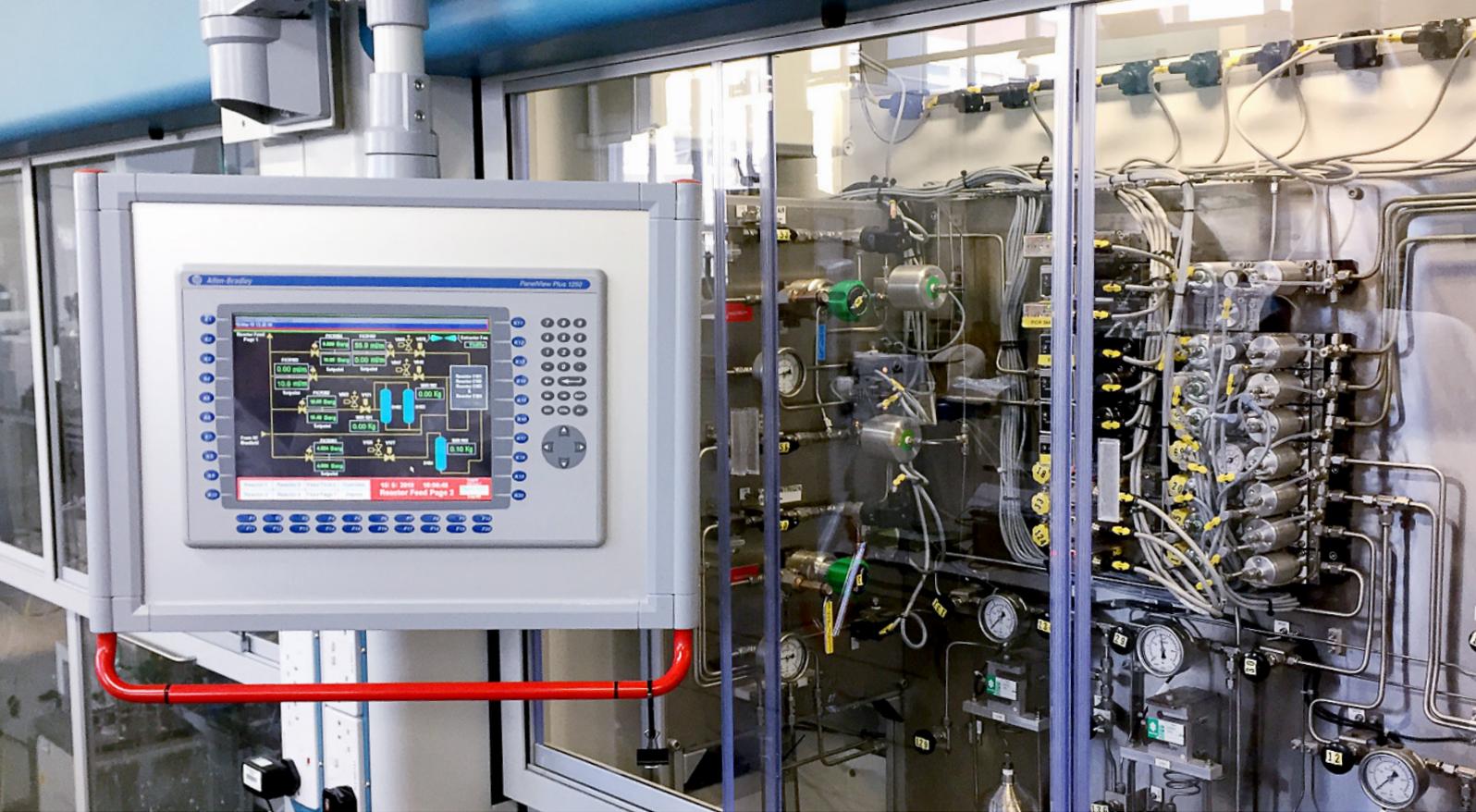


Advanced Fluorine Materials for Lithium Ion Batteries

SAFETY + PERFORMANCE





Fluorine: Enabling next generation batteries

Fluorine is as essential to lithium ion batteries as the more well-known elements lithium, nickel, cobalt and carbon. Its unique properties as the most electronegative element make it irreplaceable in electrolyte salts, solvents, additives, binders and other materials used in current batteries. Fluorine also holds the key to unlocking the full potential of next generation battery technologies.

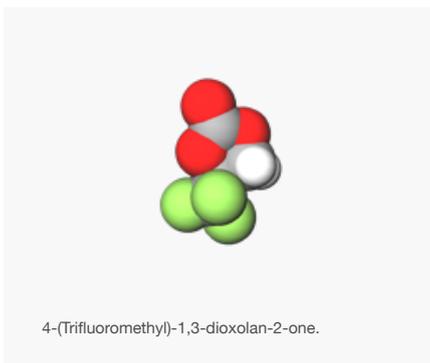
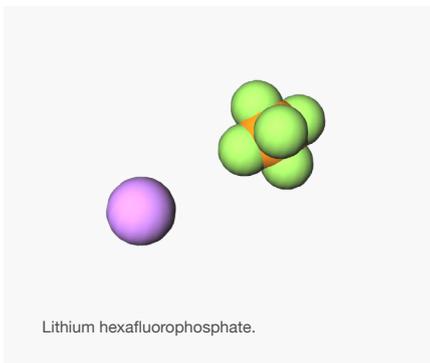
The lithium ion battery industry is expanding to meet the needs of vehicle electrification, large-scale energy storage and mobile electronic applications. Next generation fluorine-based additives and co-solvents will be needed to deliver batteries with higher capacity, longer lifetime and improved safety. The rapidly expanding battery industry needs a secure supply chain of key battery materials, including fluorine. Access to fluorine will become more challenging as the demand for it from batteries and other applications grows.



5,5-Difluoro-1,3-dioxan-2-one.



4-Fluoro-1,3-dioxolan-2-one.



Koura at a Glance

Koura is a fully integrated fluorine technology company with a global footprint that spans mining to the production of hydrogen fluoride, aluminum fluoride, refrigerants, medical gases, agrochemical intermediates, and battery materials.

Koura operates the world's largest fluorspar mine and holds a significant portion of the world's proven reserves of fluorine, a critical resource to the lithium battery industry.

Koura is actively developing fluorine-containing materials for use in current and next generation Li-ion batteries. Koura's unique integrated supply chain and process research and development capabilities allows us to tailor and optimise feedstock choice and supply, reaction, separations, process topography and site integration to efficiently manufacture the products we offer.

Koura operates to the highest of ethical and environmental standards and is a trusted, secure and stable supplier of fluorine-containing products and technologies. Core to Koura's beliefs is promoting the responsible and sustainable use of fluorine to advance life together with our customers.

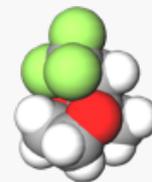
Koura's fluorine and capabilities are essential to the future of lithium ion batteries and makes us a valuable partner with whom to develop and commercialize electrolyte additives and other Li-ion battery materials.

Koura Electrolyte Solutions

Koura is actively developing new fluorinated additives and co-solvents that offer the possibility of enhanced safety and performance in Li-ion batteries.

Fluorine additives and co-solvents enable increased energy per mass of battery whilst ensuring safety. The unique properties of fluorine-containing materials make them uniquely suited for use in high energy battery environments and provide stability in all modes of operation.

Koura has developed a palette of fluorinated materials that includes a wide variety of functions, characteristics and physical properties. We are actively partnering with leaders in the battery space to tailor and commercialize fluorinated additives and co-solvents.



2-(2,2,2-Trifluoroethyl)-1,3-dioxolane

Fluorinated electrolyte additives and solvents

Fluorinated ethers including vinyl ethers, cyclic and acyclic ethers

- Oxidative stability and excellent cyclability at high cell voltages
- Flammability suppression
- Low viscosity
- Improved separator wettability
- Good compatibility with common carbonates and fluorinated carbonates
- Compatible with wide range of anode chemistries including silicon containing

Fluorinated acyl esters

- Enabling low temperature performance and wider temperature range
- Reduced gas generation and cell swelling compared to carbonate esters
- Improved capacity retention
- Oxidative stability and excellent cyclability at high cell voltages
- Flammability suppression
- Improved solubility with certain lithium salts
- Compatible with wide range of anode chemistries including silicon containing



Fluorinated cyclic and acyclic carbonate esters

- Improved process chemistry and manufacturing
- Improved SEI layer formation
- Improved capacity retention
- Oxidative stability and excellent cyclability at high cell voltages
- Flammability suppression
- Compatible with wide range of anode chemistries including silicon containing

Fluorinated polyether solid polymer electrolytes and monomers

- Very low flammability even compared to Polyether based materials
- Safe operation in high risk applications
- Combined Li-ion conductor and separator
- Reduced manufacturing costs
- Stable at high voltages
- Compatible with Li-anodes
- Compatible with range of electrolyte salts
- Enormous scope for customization and functionalization

We work alongside our partners to develop and scale up new compounds, and accelerate technological advancements in the manufacturing process.

Please contact us for more information on how to work together, open partnerships and co-development.

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Koura is part of Orbia, a community of companies working together to tackle some of the world's most complex challenges. We are bound by a common purpose: To Advance Life Around the World