SPECIFIC POLYMERS

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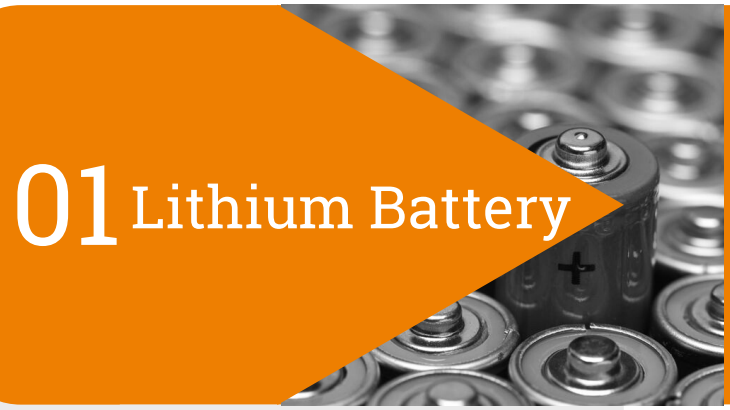
01 Lithium Battery



Introduction

For decades, lithium battery (LiB) has been growing at a very fast pace owing to its considerable advantages, notably in terms of energy density. However, with the development of high energy consuming devices, more and more powerful and fast charging Li-ion batteries are required. Thus, limitation of energy density and safety issues observed lead to perform suitable technology as Li-Metal batteries. Compared to Li-ion technology, this battery uses lithium metal as anode material requiring a gel polymer electrolyte (GPE) or a solid polymer electrolyte (SPE) to limit or supress dentritic growth.

Chemistry, performance, cost and safety characteristics vary across LIB types. Within this scope, SPECIFIC POLYMERS contributes, for couple years, to the development of tomorrow's lithium batteries by the production of a large range of lithium salts, conductive polymers, additives and plasticizers.

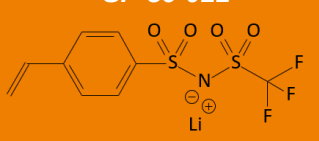
Innovative ingredients for the next generation of batteries

Lithium salts

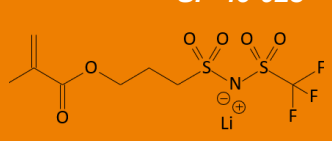
Power delivery of GPE or SPE materials is limited by the concentration gradient of the lithium salt resulting in low lithium transference number. Indeed, traditional SPEs are dual-ion conductors, i.e. both cations and anions are mobile in the polymer electrolyte phase. The mobility of both ions induces a concentration polarization and finally ends up reducing electrolyte performances. One solution, called single lithium-ion conducting polymer electrolyte, consists in immobilizing the lithium counter ion to the polymeric material.

In this way, SPECIFIC POLYMERS commercializes (meth)acrylate and styrenic monomers LiTFSI derivatives, LiMTFSI (**SP-49-023**) and LiSTFSI (**SP-59-011**), as promising single lithium-ion conductive polymer electrolyte. Indeed, TFSI moiety is considered as the best candidate for Li salt in lithium batteries and LiTFSI is highly soluble in the usual solvents.It is noteworthy that polymerization of these such salts can be performed by conventional or controlled radical polymerization (RAFT or ATRP). By the way, studies on their polymerization and development of new salts are underway.

SP-59-011



SP-49-023



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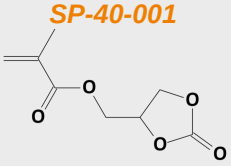
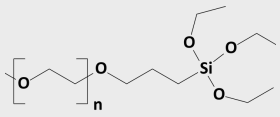
Additives & plasticisers

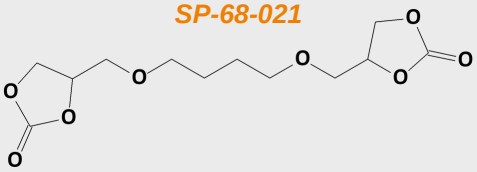
SP-40-001



SP-1P-2-001



SP-68-021

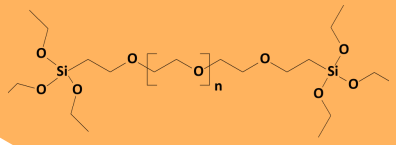


Additives and plasticizers are widely used to enhance the performance and the safety of GPE and SPE. To avoid safety issues due to leak or flammability risks, SPECIFIC POLYMERS develops low vapor pressure compounds as cyclic carbonate or organosilicon. Low viscosity, high mobility, large electrochemical stability window and high dielectric constant enable electrolyte performances improvement.

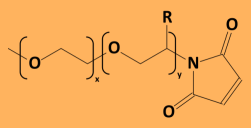
Conductive polymers

Within GPE or SPE, lithium conductivity is predominantly ensured by polyethylene glycol (PEO), polypropylene glycol (PPO) or polyesters. Polymers composition and architecture can be tuned to promote SPE self-organization and thus improve lithium conductivity, limit transference or avoid dendrites. SPECIFIC POLYMERS possesses a rich brochure of functionals PEO and PEO/PPO with various molecular weight or PEO/PPO ratio.

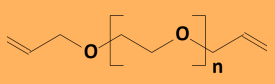
SP-1P-2-006



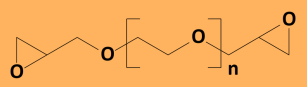
SP-1P-9-016



SP-1P-5-001

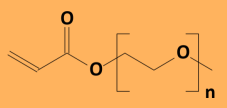


SP-1P-5-005

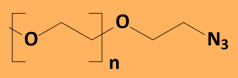


Moreover, thanks to our expertise, on-demand polymer synthesis can be performed by conventional or controlled radical polymerization (RAFT or ATRP). Moreover, our macromonomers can found interest either in radical or cationic UV-polymerization or sol-gel chemistry.

SP-1P-7-005



SP-1P-2-006



Analytical expertise

Academics and industrials can rely on our analytical facilities for their specific needs such as chemical composition analysis, conformity control (raw materials or end-products), thermal stability and so on. We dedicated doctors and engineers working in close collaboration to solve customers issues.

R&D partnering

We are always looking forward to establish and optimize synthetic routes for the development of innovative compounds having a noteworthy future in energy field. Additionally, we are also seeking for collaborations with industrial and academic partners to participate in national and international R&D projects.