Lithium Hexafluorophosphate

PEP Review 2025-04

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Glossary

°F	Degrees Fahrenheit
°C	Degrees Celsius
$/kg	Dollars per kilogram
A,B	Two units in alternating use or with time-staggered start times
A&B	Two units operating in parallel
AHF	Anhydrous hydrogen fluoride
atm	Atmospheres
Atm.	The atmosphere
BFD	Block flow diagram
BLI	Battery limits investment
CEI	Cathode electrolyte interphase
CIF	Cost, Insurance, and Freight, a waterway shipping term defined by the International Chamber of Commerce's International Commercial Terms, wherein the seller is responsible for packaged goods from the point of the seller's warehouse to their final destination
EG	Ethylene glycol
EPDM	Ethylene propylene diene monomer, a thermoset rubber
FFKM	Acronym for Fiombonan'ny Fiangonana Kristiana eto Madagasikara, a class of perfluoroelastomer having especially high fluorine content
FKM	Abbreviation of Fluorkautschukmaterial (fluorine rubber material), a class of fluoroelastomer containing vinylidene fluoride and other monomers. Originally branded as Viton.
FOB	Free on board, a waterway shipping term defined by the International Chamber of Commerce's International Commercial Terms, wherein the buyer becomes responsible for all aspects of transporting packaged goods from the point of the seller's warehouse to the final destination
FRP	Fiber-reinforced plastic
G&A	General and administrative (a cost category)
gal	US gallons
h	Hour(s)
HC	Hastelloy C
HDPE	High density polyethylene, a thermoplastic polymer
HPG	High purity grade
Hytrel™	Brand of thermoplastic polyester elastomer
kg	Kilograms
kJ	Kilojoules
ktpa	Kilotons per annum, thousand metric tons per year
kW	Kilowatt
kWh	Kilowatt-hours
L	Length
L/D	Aspect ratio, (length or height)/diameter
LDPE	Low-density polyethylene, a thermoplastic polymer
lb	Pound(s)
LCE	Lithium carbonate equivalent
lpm	Liter per minute
min	Minute(s)
MJ	Megajoules
mol%	Molar percent
molal	Moles solute per kg solvent
MS	Mild steel
Nm^3	Normal cubic meters
Nominal	Used in many contexts, this term refers to the value available when operating at 100% of theoretical or nameplate capacity
Noryl™	Brand of thermoplastic that is a blend of polyphenylene ether and polystyrene
PCTFE	Polychlorotrifluoroethylene, a thermoplastic polymer also known by brand as Kel-F®
PEEK	Polyether ether ketone, a thermoplastic polymer
PFD	Process flow diagram
PP	Polypropylene, a thermoplastic polymer
ppmw	Parts per million by weight

PPS	Polyphenylene sulfide, a thermoplastic polymer
psi	Pounds per square inch
psia	Pounds per square inch absolute
psig	Pounds per square inch gauge
PTFE	Polytetrafluoroethylene, a thermoplastic polymer
PUR	Polyurethane
PVC	Polyvinyl chloride, a thermoplastic polymer
PVDF	Polyvinylidene fluoride, a thermoplastic polymer
ROI	Return on investment
s	Second(s)
scf	Standard cubic feet
SEI	Solid electrolyte interphase
Staggered	Staggered units perform the same operation with different start times; typically, each carries the entire time-averaged process flow and the number of units is equal to the residence time per unit in hours divided by 1 process hour
t or ton	Metric ton(s), also known as tonne(s)
tpa	Metric tons per annum (year)
TFC	Total fixed capital
VAT	Value added tax, levied in some countries on the difference between the product's selling price and the amount paid for raw materials
vol%	Percent by volume
wt%	Percent by weight
y	Year(s)

Abstract

This review, Lithium Hexafluorophosphate, provides process design and economic analyses for production of lithium hexafluorophosphate, $LiPF_6$. At 99.98 wt% purity, the product is suitable for use in lithium-ion batteries and for some applications in the ceramics and optics sectors.

Production costs for battery-grade lithium hexafluorophosphate depend most heavily on raw material costs, followed by factors related to capital costs. This first-of-a-kind analysis evaluates design and Level 3 economics for $LiPF_6$ production at a typical new line addition capacity of 10,000 tons/year.

Lithium hexafluorophosphate is sold both in solid form and as a solution. On a lithium metal basis, the global production volume of $LiPF_6$ in 2024 was 8.1 ktpa, which corresponds to production of 177 ktpa of $LiPF_6$ on a solid basis (S&P Global Energy Chemical Economics Handbook). Despite continued demand growth, market prices for lithium chemicals, especially battery-grade lithium chemicals, have been in a slump due to oversupply. The present analysis shows that achieving profitability for $LIPF_6$ production during 2025 is challenging, even in China, and that this situation can rectify as the market improves.

The overall market for lithium hexafluorophosphate is overviewed, as are the major producers and their production capacities. Production of $LiPF_6$ by the standard route, from chlorinated precursors, hydrogen fluoride, and lithium fluoride, is reviewed in detail. Recent modifications or alternative processes, involving changes to the solvent or the sources of fluoride, phosphorous, or lithium, are reviewed.

The requisite purity of raw materials and product are discussed, as is the need to avoid water. The process makes several saleable coproducts, and the major coproduct derives from the five molar equivalents of hydrogen chloride generated per mole of $LiPF_6$. The present analysis evaluates the process economics of producing $LiPF_6$ with the following options for the major coproduct:

- 30% aqueous hydrochloric acid containing 70 ppmw HF and 96 ppmw total fluoride
- 24% sodium chloride brine containing 62 ppmw total fluoride
- 99.8% calcium chloride containing 16 ppmw total fluoride

The analysis also includes quantification of waste streams and their content, carbon footprint, and water footprint for production of battery-grade lithium hexafluorophosphate with the above coproduct options.

The iPEP Navigator Lithium Hexafluorophosphate module provides an economic snapshot of the process, allowing the user to compare the process economics in several locations.

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