Higher purity PF_5 gas
at significantly lower cost

What is PF_5?

Phosphorus pentafluoride (PF_5) is a strong fluorinating agent used in organic synthesis. PF_5 is also used as a catalyst for polymerisation reactions and as a precursor for manufacturing lithium hexafluorophosphate ($LiPF_6$), an electrolyte component in lithium-ion batteries.

Lithium-ion batteries currently dominate the global rechargeable battery market, achieving over US$11 billion in sales in 2012. Sales are expected to grow to US$35 billion by 2020. These batteries are currently used in cellphones, laptops and other electronic devices, but there is a growing demand for lithium-ion batteries to power electrical vehicles, the electronics of commercial aircraft and for bulk energy storage systems, especially in the renewable energy sector.

The Necsa technology

Necsa has developed a single-step process for the production of high purity PF_5 and sodium hexafluorophosphate ($NaPF_6$).

Furthermore, with only a slight modification to the current model, phosphorus trifluoride gas (PF_3) can also be produced. This gas is an important component of etchant gas, which is used in the electronics and platinum sectors.

The need and gap

The electrolyte used in lithium-ion batteries needs to be of high purity to prevent the battery from overheating during charging and to prolong the life of various battery components.

The fluorine gas used in traditional PF_5 production processes is not only expensive, but contains corrosive hydrogen fluoride (HF) gas, an impurity which impacts on the purity of the PF_5 and by default $LiFP_6$. The removal of the HF impurity from PF_5 through distillation and other purification steps leads to further expenses.

Benefits of the new PF_5 production process

- Improved PF_5 gas purity, which is critical to the production of efficient lithium-ion battery electrolytes
- Significant cost savings
- PF_5 and $NaPF_6$ produced in one simple step, both of which are critical to lithium-ion battery production
- PF_3, which is an important component of etchant gas used in the electronics sector and as a ligand during platinum group metal purification, can also be produced after a slight modification to the process

pelchem
We're in your world

necsa
We're in your world

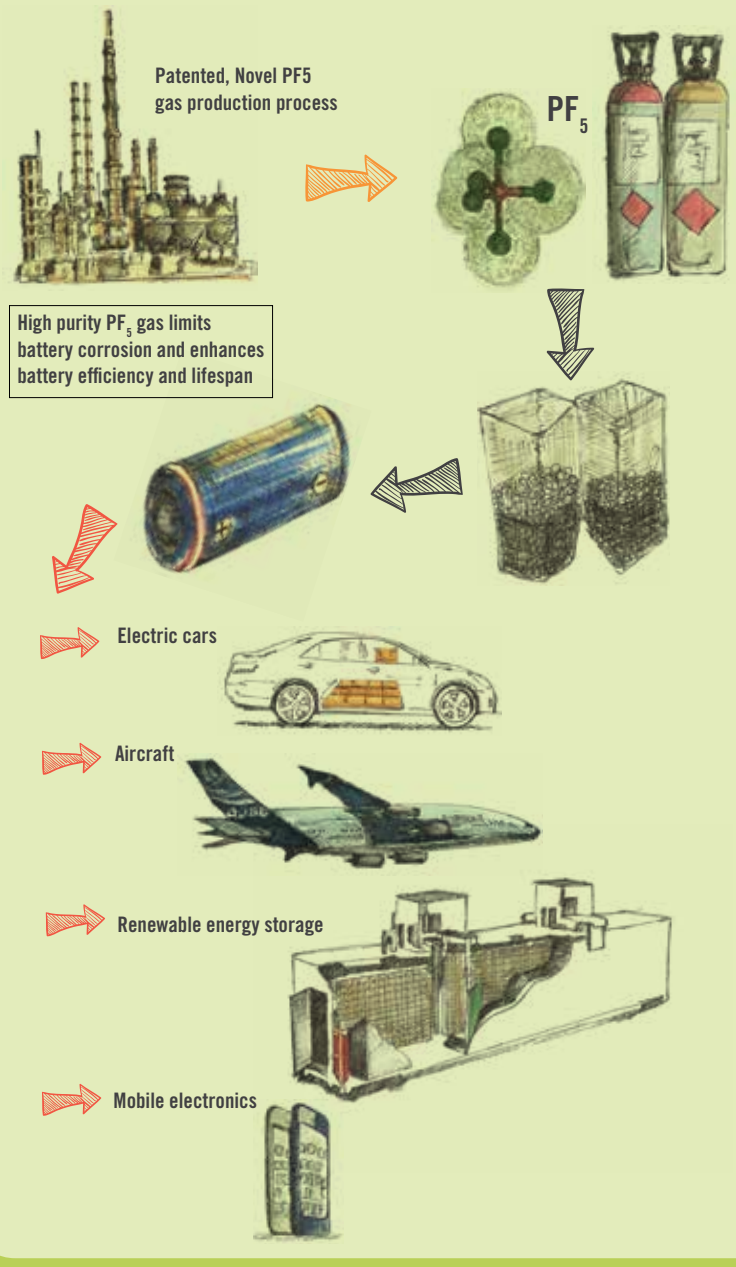
South African Nuclear Energy Corporation SOC Limited

The Necsa value proposition

By eliminating the need for purification, this breakthrough process will significantly reduce the cost of producing PF_5.

The Industrial production and application of PF_5

PF_5 gas is a crucial component for the production of efficient lithium-ion battery electrolyte, as illustrated.



Technology readiness level (TRL) and intellectual property protection

- TRL 4 – Laboratory Testing/Validation of Component(s)/ Process(es): Technology packaged for licencing – the next step is piloting for commercialisation
- Patent application filed (Application No. PCT/ IB2014/060328)

Become a partner in this technology

The following people can be contacted with regard to PF_5 gas technology:

Dr John Prior
Chief Advisor
T +27 (0)12 305 4826
E john.prior@necsa.co.za

Mpho Lekgoathi
Senior Scientist
T +27 (0)12 305 6839
E mpho.lekgoathi@necsa.co.za

Tandokazi Nquma
Analyst: IP Commercialisation
T +27 (0)12 305 4588
E tandokazi.nquma@necsa.co.za

Rajen Naidoo
Executive Manager: Pelchem
T +27 (0)12 305 4142
E rajen.naidoo@pelchem.necsa.co.za

About Necsa

Nuclear technology plays a fundamental role in day-to-day life. Applications such as medical isotopes, used in cancer treatment, and fluorochemicals, used in petroleum manufacturing and in items such as LCD screens and cellphones, enhance more than 10 million lives every year.

Necsa is at the forefront of nuclear energy and radiation science research and development (R&D) on the African continent. NTP Radioisotopes SOC Ltd, a Necsa subsidiary, is one of the top three producers of nuclear medicine in the world, while Pelchem SOC Ltd, another Necsa subsidiary, is the only fluorochemical production, sales and distribution company in the southern hemisphere.

The Applied Chemistry Group at Necsa performs R&D of commercial or Nuclear Fuel Cycle (NFC) fluorination processes/products. The focus is on the synthesis of fluoro-organics using dry fluorinating agents and supporting technologies such as molecular spectroscopy and modelling, thermal analysis and chemometrics.

K-12195 [www.kashan.co.za]