HUDSON'S BAY COMPANY
HISTORY FOUNDATION

Trinity Western University

FLUOROSPAR
Reported in 1530

Georgius Agricola

Major Fluorspar Mines

http://www.sepfluor.co.za/fluorspar

What is Fluorine?

- Lightest halogen.
- The free element is **RARELY** found in nature
- Yellow-green gas
- Diatomic molecule F_2
- Highly toxic
- Most reactive of all elements.

NAMES GIVEN TO FLUORINE

- Hellcat
- Tiger Element
- Tyranasouraurs Rex Element
- Gas of Lucifer

Adapted from Wikipedia

HYDROFLUORIC ACID
Discovered in 1771

$$CaF_2 + H_2SO_4 \longrightarrow 2\ HF + CaSO_4$$

Carel Wilhelm Scheele (Swedish Chemist)

DISCOVERY OF FLUORINE
1886

$$2\ HF \xrightarrow{KHF_2} F_2 + H_2$$

1906 NOBLE PRIZE FOR ISOLATION OF FLUORINE

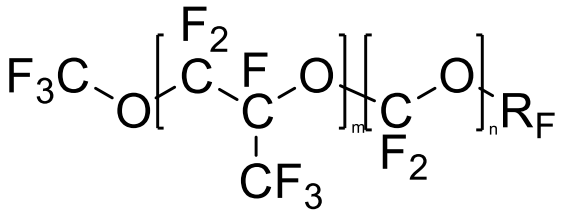
Faculté de Pharmacie, Université Paris5 - René Descartes

Fluorine properties

- Small (atomic radius = 72 pm)
- Most electronegative of all elements (3.98 on Pauling scale)
- Strongest single bond with C (466 kJ/mol)
- In the ionic form F^- is essential for strengthening teeth
- Many samples of fluorite exhibit fluorescence

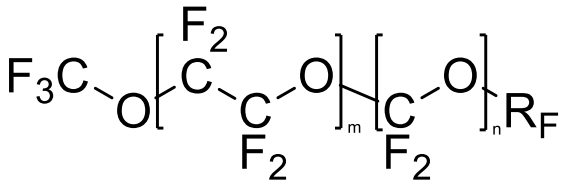
Commercial Perfluoropolyalkylethers (PFPAEs)

Fomblin® Y, Galden®:



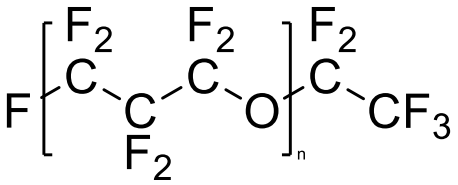
R_F= CF_3 C_2F_5, C_3F_7
m + n = 8 - 45
m/n = 20 - 1000

Fomblin® Z:



m + n = 8 - 45
m/n= 0.5 - 2

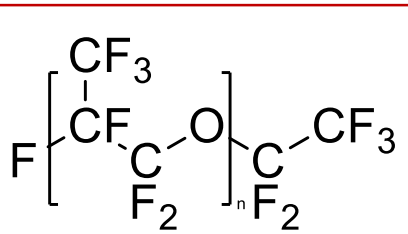
Demnum®:



n= 2 - 200

Krytox ®:

Aflunox®



n=10-60

APPLICATIONS OF PFPAEs

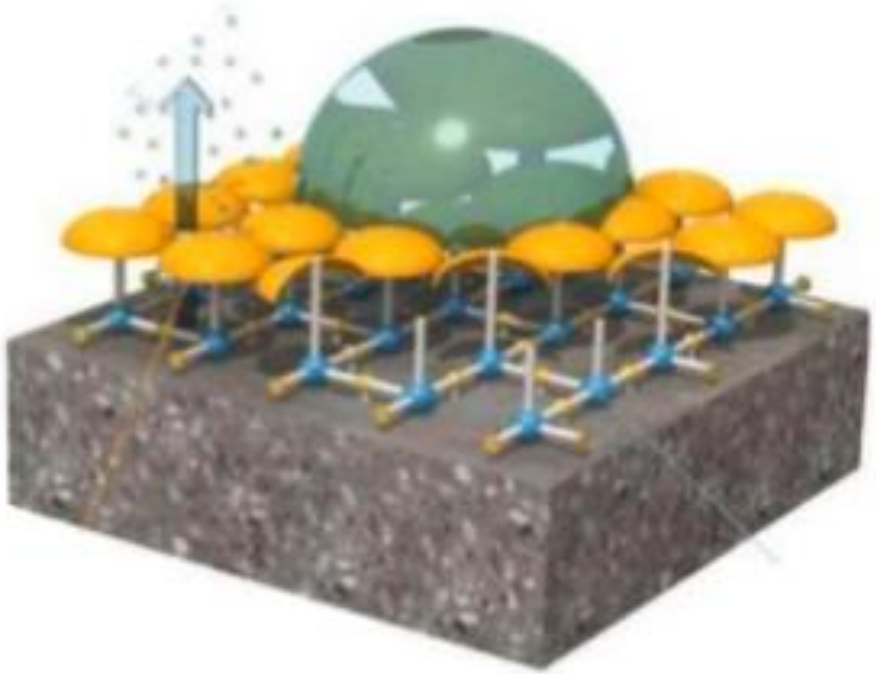
- **Aerospace**
  - Bearing lubricant (Satellites)
  - Sealant
  - O-ring lubricant
  - Oxygen systems
- **Automotive**
  - Antilock braking systems
  - Bearing lubricant
  - Weather-strip lubricant
  - CV joints
  - Spark plug and boot lubricant
- **Recreational**
  - Ski wax substitute
  - Fishing Reels
  - Bicycles
  - Soccer Shoes

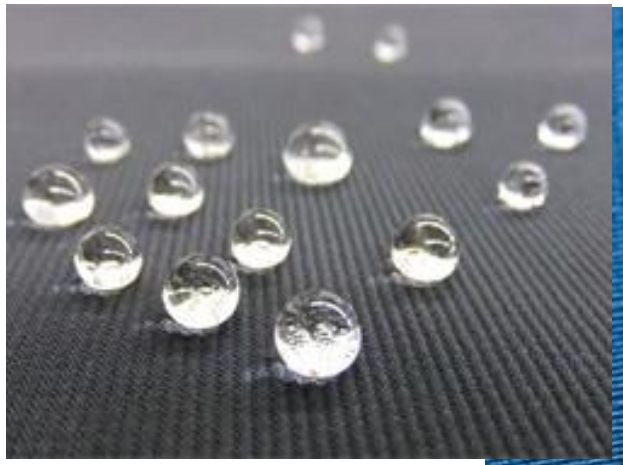


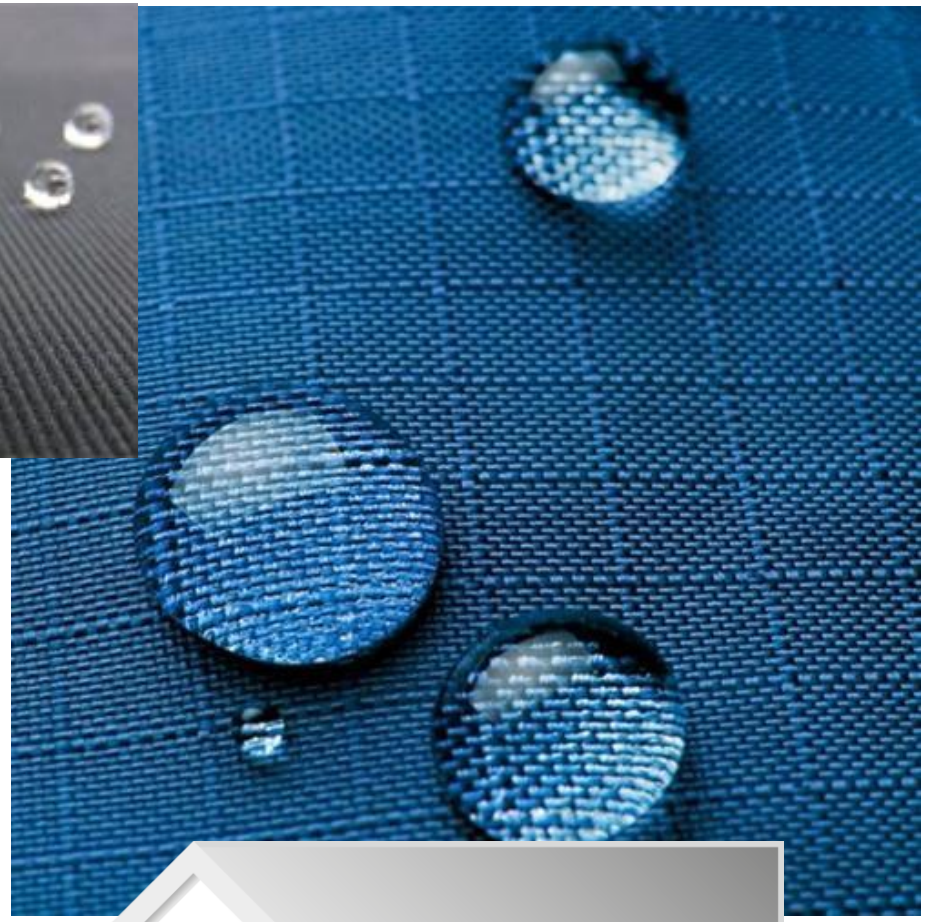




- **Industrial**
  - Paper corrugation bearings
  - Chemical plant maintenance
  - Valve lubricant
  - High-temperature equipment
  - Clean rooms
  - Nonreactive seal fluid
  - Chlorine and oxygen service
  - Textile equipment
- **Vacuum Systems**
  - Vacuum pump fluids
  - High vacuum greases
  - Vacuum system sealant
- **Cosmetics**







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Fluoro-organics

$CH_2=CH_2$

Ethene or Ethylene

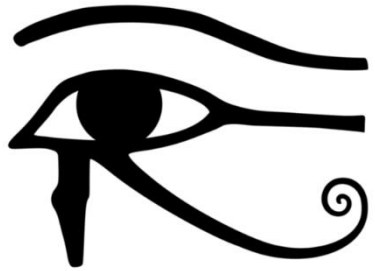
Polymer: Polyethylene (**PE**)

$CF_2=CF_2$

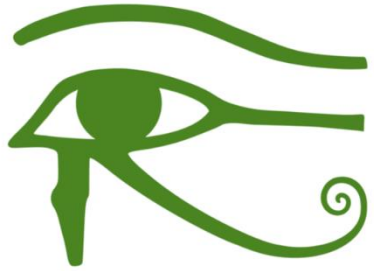
Perfluoroethene or tetrafluoroethylene

Polymer: Polytetrafluoroethylene **(PTFE)**

Fluoro-organics



R_H = alkyl group e.g. C_8H_{17}-



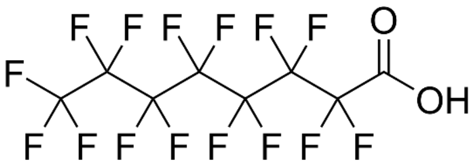
R_F = fluoroalkyl group e.g. $C_8H_{16}F$-

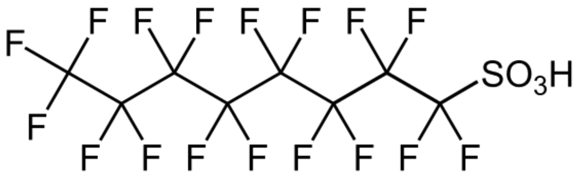
perfluoroalkyl group e.g. C_8F_{17}-

Environmental and Toxicity Challenges

DEATH TRIANGLE

- Non-biodegradable (Degradation)
- Persistence
- Bioaccumulation: binding to proteins in wildlife and human body
- Currently Banned: Perfluoroalkyl and polyfluoroalkyl substances with long chains e.g. [PFOA-C8 and PFOS (Scotch Guard)]





SCOTCHGARD™
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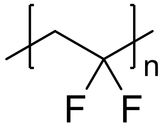
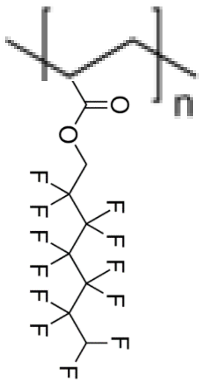
Polyvinylidenefluorides



Fluorinated polyacrylates

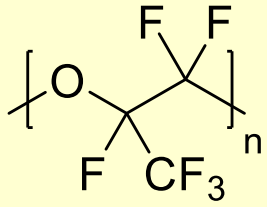


PhotoFluo project

Goal of PhotoFluo:

to prepare fluoropolymers that can be promising alternatives in terms of safety and performances to the perfluoroalkyl molecules, currently raising safety issues

Perfluoropolyethers



www.photofluo.polito.it

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