Surface Fluorination

pelchem
We're in your world

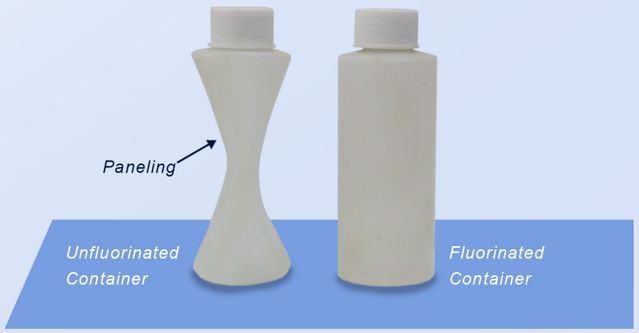
Overview

Plastic has become the material of choice in the 21st century for the containment, transporting and preserving of products. Various types of plastics are available. The most common plastic packing is High Density Polyethylene (HDPE), Low Density Polyethylene (LDPE), Polypropylene, PP for paint and PET for beverages.

The main benefits of HDPE packaging are:

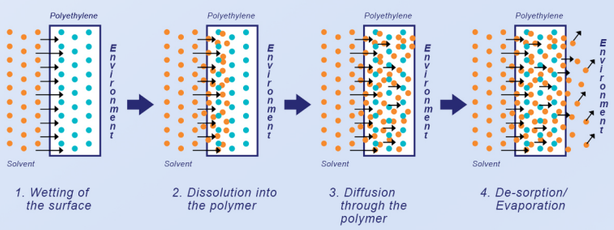
- Recylability
- Design flexibility, versatility
- Multi-trip, re-usable
- Light weight, saving on transport cost
- Durable, sturdy, safe-to-use, no breakages

A limiting factor of HDPE is its incompatibility with certain solvents. When an incompatible solvent is packed into a HDPE container, the solvent will permeate through the container walls, resulting in loss of content and the deterioration of the mechanical properties of the container. This effect is often referred to as paneling.



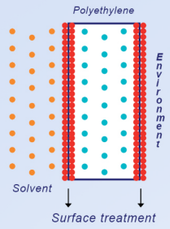
The concept of fluorination

The permeation of unfluorinated HDPE packaging takes place in four stages:



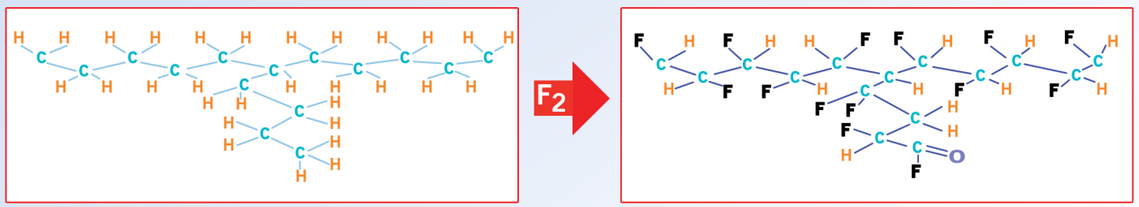
The packaging panels, discolours, labels fall off with subsequent product loss and flammable vapours released into the environment.

Fluorination changes the polarity and the surface characteristics of the polymer.



Treatment of the polymer with fluorine gas changes the surface properties of the polymer by partially substituting hydrogen atoms on the surface of a polymer with fluorine atoms resulting in a **fluorocarbon barrier layer**, which prevents solvent permeation and fragrance loss.

Schematic representation of the molecular structure:



Typical performance of fluorinated HDPE

Tests are conducted according to the USA Department of Transport, Code of Federal Regulations / Transportation; Appendix B Part 173.

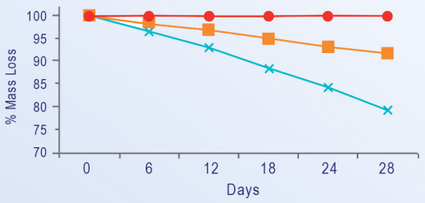
Examples of Fundamental Permeation test results:

Product	% Mass Loss – Unfluorintated	Appearance	% Mass Loss – Fluorinated	Appearance
** Paraffin	18%	Panelled	0%	No panelling
** Xylene	78%	Extreme panelling	1%	No panelling
** QD Gloss Enamel ** Paint White	47.38%	Extreme panelling	1.28%	No panelling
** Toluol Thinners	100%	Extreme panelling	0.92%	No panelling
** Resin 901	31.64%	Severe panelling	0.77%	No panelling
** Cypermetrin EC	55.90%	Panelling	1.57%	No panelling

* Tested at 60°C for 14 days * * Tested at 50°C for 28 days

Comparison Permeation test results:

Product = Trifluoralin Conditions = 50°C for 28 days



Advantages of fluorinated containers

- Reduced permeation, softening of container walls, paneling and loss of product through the container walls;
- Improved safety by containment of flammable liquids;
- Preventing discolouration, odour emissions, fragrant and flavour loss;
- Improved adhesion properties that allows painting, printing, etc of plastic surfaces;
- The Surface Fluorination process generates minimum waste and adheres to the atmospheric pollution act;
- Fluorinated containers are 100% recyclable and cost effective packaging for dangerous goods;
- Fluorinated packaging is a superior alternative for dangerous goods if compared to:
  - Metal tins wrt cost, weight, denting and corrosion;
  - Glass wrt cost, weight, breakages and cost of outer packaging;
  - PET wrt permeation, compatibility and paneling;
  - Multilayer polymers wrt recyclability, cost and delamination of layers

Quality standards

Fluorinated packaging complies to various quality standards:

- USA Department of Transport: Code of Federal Regulations / Transportation; Appendix B Part 173, Procedure for testing chemical compatibility and rate of permeation in plastic packaging and receptacles. (Containers)
- EU Economic Commission for Europe (UN ECE) (Fuel tanks)
- ERA Technology: Institude of Petroleum and Shell performance specifications (Fuel pipes)
- Carlifornian Air Resources Board (CARB) (Fuel tanks)
- Underwriters Laboratories (UL 971) (Fuel pipes)
- US Food and Drug Administration (FDA) (Containers)
- The South African National Standards, SANS 10229: Packaging, labeling and compatibility of hazardous goods offered for transport by road or rail

Typical applications of fluorinated polymers


Motor Vehicle Fuel Tanks


Fuel Jerry Cans


Fuel Pipes


Containers

Safety Health and Environment (SHE)

Pelchem maintains and adheres to a SHE management system, with comprehensive policies, instructions and procedures to ensure compliance to applicable Regulations.

Pelchem also employs a Behavioural Based Safety program (BBS) aimed at proactively reducing at risk behaviours. Like a shell fosters its pearl, Pelchem's PEARL process protects our employees through a process of structured task observations against identified critical behaviours to entrench an attitude of Pelchem Eliminating Accidents and Risks for Life (PEARL)

Pelchem is signatory to the International Responsible Care initiative as administered by the Chemical and Allied Industry Association (CAIA) of South Africa. Responsible Care is the global chemical industry's environmental, health and safety (EHS) initiative to drive continuous improvement in performance and sustainability throughout the product life cycle, and requires adopting cooperative and voluntary initiatives of performance beyond legislative and regulatory compliance, to build confidence and trust in the chemical industry that is essential to improving living standards and the quality of life.

In addition Pelchem offers technical advice and safety awareness training on safe handling of our products to our customers and potential new customers.

Quality

Pelchem acknowledges quality as utmost importance and prides itself as an ISO 9001-2008 certified manufacturer of fluorochemicals. Quality control of Pelchem products is performed by Pelindaba Analytical and Calibration Services laboratories of which some are accredited to the South African National Standards SANAS 17025.

Surface Fluorination

chemical excellence

shaping the future

Pelchem SOC LTD

PO Box 582
Pretoria 0001
South Africa

T +27 12 305 4444
F +27 12 305 4445

E cheminfo@pelchem.necsa.co.za
W www.pelchem.com

pelchem
We're in your world