



The Pensteel Range of Composite IBCs – SMP Treatment

Fluorination permutation barrier



SMP Treatment

Pensteel Limited

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...the perfect process for the future that is not harmful to the environment

The SCHUTZ SMP PROCESS, developed in close co-operation with the Linde Division of Union Carbide, is a new technology that reduces permeation of product through the HDPE is such an alternative.

SMP, "SURFACE MODIFIED PLASTICS", is an off-line fluorination process which exposes plastic-containers on both sides with fluorine gas. Union Carbide holds several patents on this process.



A cutaway schematic of a container wall showing inner and outer surface fluorination barrier.

The SCHUTZ SMP-PROCESS treats IBC's for safer storage.

LOWER ENVIRONMENTAL LOAD THROUGH SMP

Nitrogen and fluorine gas are blown into the evacuated treater, controlled through a process control computer. Fluorine concentration and treatment time can be adjusted according to permeation demands. Therefore, on the inner and outer surface a protection layer is created that is similar to PTFE (Teflon®). It greatly reduces the permeation of non-polar solvents.

SECURITY THROUGH SMP

With the SCHUTZ SMP-PROCESS plastic-containers are coated safely in a fluorination treater that is absolutely air-tight. Extra fluorine gas cannot escape from the treater but is always re-used. The double sided coating gives double protection against permeation through the plastic walls of the IBC. The excellent mechanical properties of HDPE such as tensile strength, expansion, hardness, stress cracking resistance, thermal properties and low temperature behaviour are not influenced through the SMP-treatment. Chemical resistance against inflammable, toxic and caustic materials is improved.

ECONOMICAL EFFICIENCY THROUGH SMP

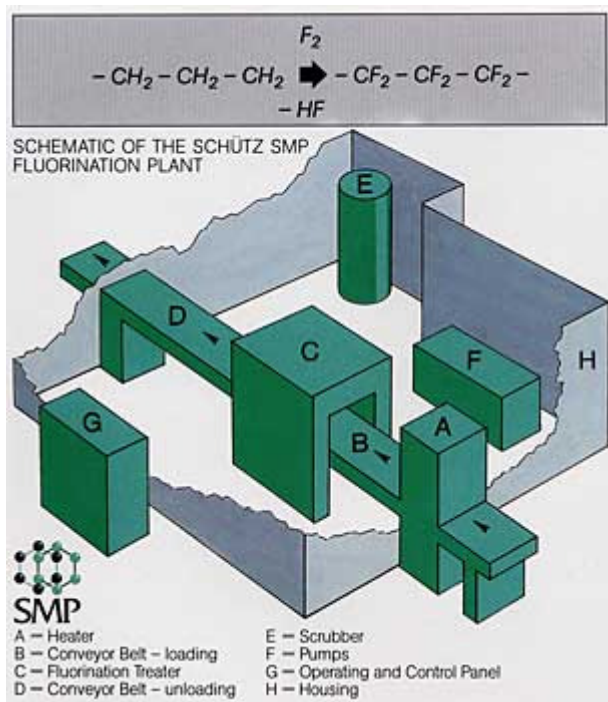
Blow moulded plastic containers show decisive advantages in comparison to normal receptacles of glass or metal. For example: high range of application, low weight, high stability, extreme durability (sturdiness), high factor of security. SMP- treated plastic containers enlarge this range of application. The double-sided fluorine coating reduces the permeation of the contents to a minimum. It intensifies the chemical resistance against highly inflammable, toxic or caustic materials and, at the same time, it also builds an odour barrier.

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The Chemistry of the Fluorination and the Barrier Effect

Fluorine is among all known elements, and it is also one gas with the highest capability of reaction (reactivity). Fluorine, as the strongest oxidation agent known, can react with all elements and compounds except light noble gases.

A treatment with fluorine serves to increase the barrier properties of HDPE against hydrocarbons. The basic reaction is a substitution of the hydrogen atoms with fluorine atoms on the chains of carbon atoms of the polyethylene macromolecules.

The permeation reduction is made in three steps:

- Due to the treatment with fluorine the surface energy of HDPE is increased substantially. This reduces the wetting property - first permeation barrier.
- The second step: Liquid hydrocarbons and the fluorinated HDPE surface show cohesive-energy densities that lie far apart. The respective solubility is therefore very small. The dissolution of the solvent in HDPE is diminished, permeation is reduced.
- The third step: During the treatment with fluorine, cross linking of the polymer chains emerge.

Therefore the proper motion of the molecule chains, the clarity and - at the same time - the diffusibility are reduced.

Treatment with fluorine only changes the polymer molecules on the surface. As the chemically changed areas are only one part of the total wall cross section, the SMP-treated containers do not have a measurable change in regards to surface tension and impact resistance.

Plastic containers without compromise

The SCHÜTZ-SMP-PROCESS opens new markets for plastic-containers as SMP-treated containers offer perfect transport security, an economical storage capability, extremely low permeation rates and a high solvent impact.

PERMEATION OF UNTREATED AND SMP-FLUORINATED HDPE-TANKS

| Short Weight in % | Untreated | SMP-Fluorinated | |
|-------------------|-----------|-----------------|----|
| Gasoline | 77.2 | 1,8 | * |
| Diesel Oil | 5,1 | 0,05 | * |
| Fuel Oil | 4,3 | 0,05 | * |
| White Spirit | 13,0 | 0,1 | * |
| Xylene | 70,8 | 4,2 | * |
| Cyclohexanone | 2,9 | 0,6 | * |
| Heptane | 37,7 | 0,2 | ** |
| Naptha | 21,2 | 0,2 | ** |
| Touol | 47,5 | 0,4 | ** |
| Turpentine | 3,9 | 0,05 | ** |

* Test conditions: 250 days at 40° C, 1mm wall thickness, not pigmented HDPE

** Test conditions: 28 days at 50° C 473 ml HDPE bottle not pigmented HDPE

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LX Range

The Schütz LX 1000 Litre IBC is manufactured with a galvanised mild steel frame and an HDPE inner bottle that can take a maximum of 1.6 SG but is only available with a heat treated timber pallet (suitable for export).



MX Range

The Schütz range of MX IBCs are manufactured with a galvanised mild steel frame with an HDPE inner bottle that can take a maximum of 1.9 SG. These IBCs are available in different sizes with a choice pallets, valves, top caps and seals.



MX-Ex Range

With the introduction of 3 layer blow moulding technology, the MX1000 Litre container is available as an "EX" container with either a black conductive or white anti-static outer layer of HDPE. Suitable for use within Zone 1 and 2 areas. both with "white antistatic" and "black conductive" IBC outer layers protect the container from hazardous electrical discharge. Only available with a metal pallet.



MX-EV Range

Designed to eliminate the need for fluorination of the IBC bottle, the MX-EV EVOH, is manufactured with 6 layer technology and safely protects the filling product from permeation. EVOH is a highly effective barrier that prevents the entry of oxygen or gases and prohibits the discharge of flavours or odour.



SX Range

The unique Schütz 1000 Litre SX-EX IBCs comes complete with a full metal jacket, encased in a galvanised mild steel frame for filling within Zone 1 and 2 areas, or for those products requiring that special protection. They are manufactured with an HDPE inner bottle that can take a maximum of 1.9 SG but is only available with a metal perimeter pallet.



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