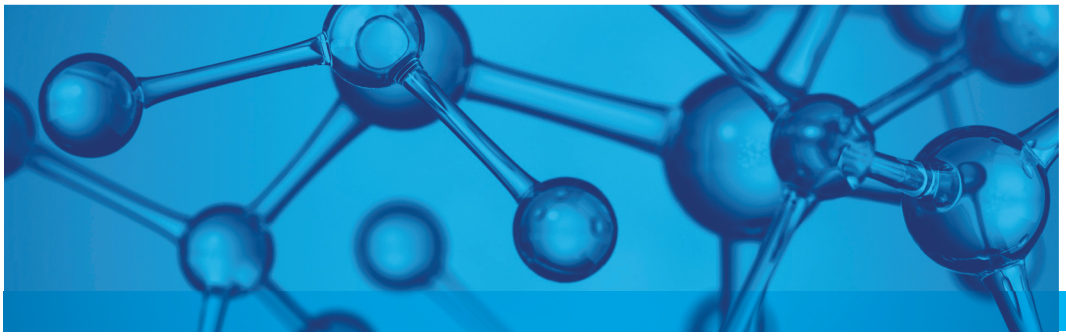

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Fluorolink® E-Series PFPE Application Reference

Fluorolink® E-Series PFPE are a family of functional perfluoropolyethers bearing hydroxyl end-groups.

They can be used as building block for the modification or synthesis of fluorinated polyurethanes, polyesters, epoxies and acrylates.

They are especially suitable for the preparation of partially fluorinated block copolymers employed in those applications requiring water and oil repellency, low friction, low refractive index or in environments where a reduction of the surface energy is the key requirement.

The following information help in the best possible use of Fluorolink® PFPE ethoxylated macrodiols for the synthesis of fluoro-modified polyurethane polymers.

Before Use

Fluorolink® E-Series PFPE are fairly hygroscopic materials. It is highly recommended to dry the product under vacuum at temperature not exceeding 90 °C and possibly checking the residual amount of water content till traces.

Compatibility

Fluorolink® E-Series PFPE can be used in combination with all common raw materials employed in polyurethane synthesis:

Isocyanates
Both aromatic (TDI, MDI) and aliphatic (IPDI, H-MDI) isocyanates react with hydroxyl groups of Fluorolink® E-Series PFPE.

Polyols
The use of Fluorolink® E-Series PFPE as polymer modifiers is/could be done in combination with standard as well as special polyols (Polyether polyols, Polyesther polyols PolycarbonateDiol, PCL, etc).

Polyurethane catalysts
Both amine based or metallic compounds (Bismuth, Tin and Zirconium based complexes and salts among others) can be used, the latter being preferred for the lower temperature of reaction allowed.

Chain extenders and cross-linkers
These reactants are not commonly affected by the presence of Fluorolink® E-Series PFPE in the recipe.

Synthesis Options

The polymerization technique should take into consideration the low compatibility of PFPE building blocks with the hydrogenated species which compose the recipe.
For this reason, two main procedures could be employed, depending on whether you want to synthesize a highly fluorinated polyurethane (mainly composed of Fluorolink® E10/H) or a partially fluorinated polymer.

Highly fluorinated polyurethanes

- Improved chemical and thermal resistance together with surface properties
- Typical concentration up to 20 % wt/wt

Two steps process:

1. If required, mix the isocyanate with catalyst in solvent (1:1 weight ratio vs. PFPE-diol), warm-up the reaction mixtures at reflux and add dropwise (in 2 h) Fluorolink® E-Series PFPE to the solution; keep reacting for at least 2 h at 90 °C under a nitrogen blanket.
2. After removal of the solvent (if needed) add the appropriate chain extender and/or cross-linker to form the pre-polymer mixture for further casting or molding procedures.

Partially fluorinated polyurethanes with Fluorolink® E10/H

- For decreased coefficient of friction and improved abrasion resistance
- Typical loading 0.5–5 % wt/wt

Three steps process*:

1. Mix the isocyanate with hydrogenated polyols and catalyst (if necessary); keep reacting for at least 2 h at 90 °C under nitrogen blanket to form the hydrogenated pre-polymer.
2. Add the desired amount of Fluorolink® E10/H to the hydrogenated pre-polymer; keep reacting for at least 2 h at 90 °C under nitrogen blanket.
3. Add the appropriate chain extender and/or cross-linker to eventually prepare the formulation for further casting or molding procedures.

** the 3-steps process is not required with the polyethoxylate diols*

Clean-Up

To ease the cleaning of pumps and equipments in contact with Fluorolink® E10/H, it is recommended to use fluorinated or hydrofluorinated solvents.
Refer to the following table to see the typical solubility of Fluorolink® E10/H in some solvents.

Solubility of Fluorolink® E10/H

Solvent	Solubility [wt%]
Water	Not soluble
IPA	< 0.1 % or > 50 %
Ethanol	< 0.1 % or > 50 %
Ethyl Acetate	< 0.1 % or > 50 %
MEK	< 0.2 % or > 50 %
Acetone	< 0.1 % or > 30 %
HFE 7100	0–99 %
Galden® HT55	< 5 % or > 30 %

The solubility test was performed at 25 °C.
The results presented are indicative of the typical properties of our product. Some variations can be expected from lot to lot.

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