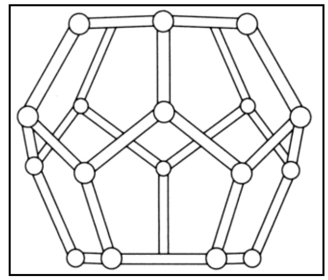
Zotefoams plc

Technical Information Sheet - TIS 06
(previously T8)
Chemical Resistance of Azote Foams



INTRODUCTION

Contact with chemicals can have detrimental effects on polymeric materials. The resistance to chemical attack and degradation of a foamed material is directly related to the chemical resistance of the base polymer used in the production of the foam. The extent of any chemical attack on polymeric materials is governed by a combination of several factors which include the type of foam, the type of chemical, the length of exposure and the temperature of exposure as well as “external factors” such as stresses exacted on the foam.

The base materials for the Plastazote® range, low density polyethylene (LDPE) and high density polyethylene (HDPE) are generally considered to have high resistance to chemical attack and are insoluble in many solvents at room temperature.

Crosslinking and crystallinity increase the chemical stability of the polymer by reducing the solubility of the material while polar properties result in a reduction of the chemical resistance. The combination of lower crystallinity and higher polarity of the EVA copolymers used in the Evazote® foam ranges causes these foams to be less resistant to chemical attack than the foams from the Plastazote® ranges.

The density of the foam will only have minor influence on the overall chemical resistance. Generally higher density foams will have slightly improved chemical resistance compared to lower density foam from the same material.

Overall the chemical resistance of Azote products can be ranked from highest resistance to lowest as follows:
Plastazote® HD > Plastazote® LD/MP > Evazote® VA > Evazote® EV > Supazote® EM

TYPES OF CHEMICAL ATTACK

Chemical attacks on polymers occur not only at varying rates dependent on the combination of polymer and chemical but also two different types of attack can be distinguished.

Swelling and (partial) solvation of the polymer can cause softening of the material, deformation and loss or deterioration of mechanical and physical properties. This type of attack is usually accompanied by permeation of the solvent into the polymer structure. The original properties of the material can often be restored by evaporation of the solvent, though dimensional changes can occur in more severe cases. Recovery of the original properties is usually better in solid materials compared to foams since the softening can cause a permanent collapse of the cell structure. Hydrocarbons such as fuels and chlorinated solvent typically attack polyolefins by this mechanism.

The second type of attack is changes in the polymer structure induced by the presence of a chemical. These changes are usually observed in form of degradation of the polymer. Polymer degradation can occur via various mechanisms of which chain scission and oxidation are the most common ones. Effects of this type of attack are permanent and cannot be reversed by removal of the chemical. Strong oxidising agents, e.g. acids, attack polyolefins by this mechanism.

EXTENT OF ATTACK

The extent to which a foam is attacked by a chemical is dependent on several factors. Below a guideline of the effects of each parameter on its own is given but combinations of several detrimental factors can cause more severe attacks.

Temperature	Rate and extent of attack increases with raised temperatures
Extent of contact (continuous/ intermittent/ total immersion/splashes)	Greater contact increases extent of attack
Length of contact	Longer exposure times increase extent of the attack
Concentration of chemical	Higher concentrations increase extent of the attack

GUIDANCE RESISTANCE RATINGS

The data summarised below is derived from direct testing of products and extrapolation of data available on the chemical resistance of the base polymer. The data in this table should only be used for guidance purposes. If chemical resistance is critical we recommend testing of the material under end use conditions to determine the suitability of the foam for a specific application.

The ratings given in the table are based on exposure at 20 °C. The effects of each chemical have been graded from 0 to 4 using the following system:

Grade	Effect	Foam life expectancy
0	Virtually no effect	Satisfactory for long term continuous contact over several years
1	Minimal effect	Satisfactory for continuous contact over several month
2	Some effect with noticeable deterioration of properties	Satisfactory for intermittent contact Continuous contact several weeks
3	Substantial effect	Satisfactory for short term contact Continuous contact several days
4	Catastrophic effect	Not recommended expect for incidental contact Deterioration of properties within hours

Chemical class	Chemical	Plastazote® range	Evazote® range
Acid	Acetic	0 (D) 0 (C)	0 (D) 0 (C)
	Formic	0 (D) 1 (C)	0 (D) 1 (C)
	Hydrochloric	0 (D) 0 (C)	0 (D) 0 (C)
	Nitric	0 (D) 1 (C)	1 (D) 1 (C)
	Sulphuric	0 (D) 1 (C)	0 (D) 1 (C)
Alkali	Ammonium Hydroxide	0 (D) 0 (C)	0 (D) 0 (C)
	Potassium Hydroxide	0 (D) 0 (C)	0 (D) 0 (C)
	Sodium Hydroxide	0 (D) 0 (C)	0 (D) 0 (C)
Aqueous Salt*	Water	0	0
	Brine	0	0
	Detergents	0	0
	Bleach	1	1
Fuel	Aviation fuel	4	4
	Diesel Fuel	4	4
	Paraffin	4	4
	Petrol	4	4
Gas	Carbon Dioxide	1	1
	Chlorine	2	3
	Fluorine	2	3
	Hydrogen	0	0
	Ozone	1	2
	Propane	4	
Oil	Castor Oil	0	
	Cod Liver Oil	0	2
	Lanolin	0	1
	Linseed Oil	0	1
	Mineral Oil	2	3
	Motor Oil	0	
	Olive Oil	0	2
	Paraffin Oil	1	2
Alcohol	Allyl Alcohol	1	2
	Butyl Alcohol	1	1
	Ethyl Alcohol	0	0
	Isopropyl Alcohol	0	0
	Methyl Alcohol	0	0
Amine/Amide	Dimethylformamide	0	2
Chlorinated Solvent	Carbontetrachloride	4	4
	Chloroform	4	4
	Perchloreoethylene	4	4
	Trichlorethane	4	4
	Trichlorethylene	4	4
Ester	Amyl Acetate	2	3
	Dibutyl Phthalate	0	3
	Diethyl Phathalate	0	3
	Ethyl Acetate	1	3
Ether	Diethyl Ether	4	4
Glycol	Ethylene Glycol	0	0
	Triethylene Glycol	0	0

Chemical class	Chemical	Plastazote® range	Evazote® range
Aliphatic Hydrocarbon	Cyclohexane	4	4
	Decalin	4	4
	Heptane	3	4
	Hexane	4	4
	Pentane	3	
	White Spirit	4	
Aromatic Hydrocarbon	Benzene	4	4
	Toluene	3	4
	Xylene	4	4
Ketone	Acetone	1	3
	Methyl Ethyl Ketone	1	3
Sealant/ Adhesive	Acrylic Sealants	0	
	Silicone Sealants	0	0
	Hot Melt Adhesives	0	0
	Solvent Based Adhesives **	0	0
	Water based Adhesives	0	0

*Inorganic salts generally have no effect (0 rating)

** Hydrocarbons or chlorinated solvents in solvent based adhesives evaporate quickly and are unlikely to have any effect on foams in normal use

D – diluted   C - concentrated

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