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Resistance of expanded materials to chemicals

The resistance of expanded foams made from Styropor to chemicals corresponds to that of moldings made from polystyrene. However, because Styropor's cell structure gives the material a greater surface area, damage occurs more rapidly and to a greater extent than is the case with the dense parent polystyrene material. Accordingly, foamed materials of low bulk density are attacked more rapidly and to a greater extent than those of higher density.

In practice (e.g. in the construction or packaging sectors) it is very important to know how expanded materials made from Styropor react to chemical substances in order to prevent faults in application.

Test

The test for resistance is based on DIN 53428 "Testing of expanded foam materials; Determination of the reaction to liquids, vapors, gases and solid materials". In this DIN standard, 5 foam cubes without expansion skin and with sides measuring 5 cm are immersed in the test medium for a definite length of time and changes occuring in the test samples, e.g. in mass and dimensions, are determined. The exposure time depends on the test medium: for liquids it is 72 hours; for gases 24 hours; and for liquefied gases, at least three hours.

For liquefied gases the immersion temperature is at, or just under, the boiling point of the test medium in question; in other media, immersion takes place at room temperature.

For visual assessment of damage, DIN 53428 suggests a scale of criteria from 0 (no change) to 5 (severely damaged). To provide a simplified overview, the table overleaf contains the following assessment criteria:

\+ = unchanged (≙ 0)
= resistant
+– = slight change (≙ 2)
= limited resistance
(small change in dimensions)
– = severely damaged (≙ 5)
= not resistant

If expanded Styropor foams are to come into contact with substances of unknown composition that could contain damaging solvents (e.g. paints or adhesives) it should be ensured in advance that the foam is not attacked by carrying out a trial under field conditions. The trial may be shortened considerably if it is carried out at temperatures above 20 °C (e.g. 50 °C). To obtain clearer evidence of the foam's resistance, the severity of the test conditions can be increased by testing a foam whose density is much lower than that intended for the actual application.

The table overleaf shows the resistance of expanded foam made from Styropor to the most important chemical substances.

Substance	Styropor P & F foams
Seawater	+
Water	+
Alkalis:	
Ammonia water	+
Bleaching solutions (hypochlorite, hydrogen peroxide)	+
Potassium hydroxide solution	+
Lime water	+
Caustic soda solution	+
Soap solutions	+
Dilute acids:	
Formic acid, 50 %	+
Acetic acid, 50 %	+
Hydrofluoric acid, 4 %	+
Hydrofluoric acid, 40 %	+
Phosphoric acid, 7 %	+
Phosphoric acid, 50 %	+
Nitric acid, 13 %	+
Nitric acid, 50 %	+
Hydrochloric acid, 7 %	+
Hydrochloric acid, 18 %	+
Sulfuric acid, 10 %	+
Sulfuric acid, 50 %	+
Concentrated acids:	
Formic acid, 99 %	+
Acetic acid, 96 %	–
Propanoic acid, 99 %	–
Nitric acid, 65 %	+
Hydrochloric acid, 36 %	+
Sulfuric acid, 98 %	+
Fuming acids:	
Nitric acid	–
Sulfuric acid	–
Anhydrides:	
Acetic anhydride	–
Carbon dioxide, solid	+
Sulfur trioxide	–
Weak acids:	
Humic acid	+
Carbonic acid	+
Lactic acid	+
Tartaric acid	+
Citric acid	+
Gases:	
a) inorganic	
Ammonia	–
Bromine	–
Chlorine	–
Sulfur dioxide	–
b) organic	
Butadiene	–
Butane	–
Butene	–
Natural gas	+
Ethane	+
Ethene (ethylene)	+
Ethyne (acetylene)	+
Methane	+
Propane	+
Propene (propylene)	+
Propene (propylene) oxide	–

Substance	Styropor P & F foams
Liquefied gases:	
a) inorganic	
Ammonia	+
Inert gases	+
Oxygen	+
(risk of explosion)	
Sulfur dioxide	–
Nitrogen	+
Hydrogen	+
b) organic	
Methane	+
Ethane	+
Ethene	–
Ethene oxide	–
Ethyne (acetylene)	–
Propane	–
Propene	–
Propene oxide	–
Butane	–
Butene	–
Butadiene	–
Natural gas	+
Aliphatic hydrocarbons:	
Cyclohexane	–
Diesel fuel, Heating oil	–
Heptane	–
Hexane	–
Paraffin oil	+–
White spirit 55 – 95 °C	–
White spirit 155 – 185 °C	–
Vaseline	+
Gasoline (regular & super grades)	–
Alcohols:	
Methanol	+–
Ethanol	+–
Ethylene glycol	+
Diethylene glycol	+
Isopropanol	+
Butanol	+–
Cyclohexanol	+
Glycerin	+
Coconut oil alcohol	+
Amines:	
Aniline	–
Diethylamine	–
Ethylamine	+
Triethylamine	–
Miscellaneous organic substances:	
Acetone	–
Acetonitrile	–
Acrylonitrile	–
Dimethylformamide	–
Esters	–
Ethers	–
Halogenated hydrocarbons	–
Ketones	–
Paint thinners	–
Olive oil	+
Tetrahydrofuran	–

Substance	Styropor P & F foams
Inorganic building materials:	
Anhydrite	+
Gypsum	+
Lime	+
Sand	+
Cement	+
Organic building materials:	
Bitumen	+
Water-based rapid-curing cutback and bituminous knife fillers	+
Solvent-based rapid-curing cutback and bituminous knife fillers (free from aromatics)	–
Aromatics:	
Benzene	–
Cumene	–
Ethylbenzene	–
Phenol, 1 % aq. soln.	+
Phenol, 33 % aq. soln.	–
Styrene	–
Toluene	–
Xylene	–
Vapors of:	
Camphor	–
Naphthalene	–

Styropor FH 106 can be used to produce expanded foams that have increased resistance to aromatic-free hydrocarbons by comparison with other Styropor grades. The suitability of this product for a particular application must be checked in each case.

Note

The information submitted in this publication is based on our current knowledge and experience. In view of the many factors that may affect processing and application, these data do not relieve processors of the responsibility of carrying out their own tests and experiments; neither do they imply any legally binding assurance of certain properties or of suitability for a specific purpose. It is the responsibility of those to whom we supply our products to ensure that any proprietary rights and existing laws and legislation are observed.

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