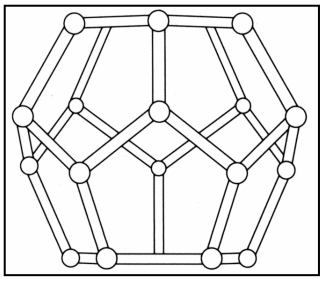
Zotefoams plc



Technical Information Sheet - TIS 14
(previously T11)
Compliance of Azote Foams with Automotive Standards

INTRODUCTION

Components used during manufacturing of cars have to comply with a set of standards set either by the car manufacturer (Manufacturer specific guidelines and test requirements), a national governing body (e.g. FMVSS in the USA or VDA in Germany) or more general EN or ISO norms. In Europe many of these norms and standards are based on legislation set out in European directives such as the 'ELV' directive (Directive 2000/53/EC on end of life vehicles).

Most tests that Zotefoams materials have been subjected to regard the performance of the foam in the interior of cars where Fogging (condensation of fumes on the windscreen), Odour, identification of organic compounds and burning behaviour are of main concern. Results for these tests are listed in the sections below with a description of the analysed parameter.

FOGGING

Fogging describes the phenomenon familiar to many drivers where vision can be severely impaired due to formation of a liquid film on the windscreen surfaces by condensation of moisture and other chemicals. The sources of these chemicals are often rubber and plastics materials fitted in the interior of the car. Chemical contamination or volatile additives or constituents in the polymeric materials are the most common source of such chemicals in new cars. To reduce the fogging caused by the materials used in the manufacturing process each material is tested for its fogging potential.

Two types of test are generally used to assess the fogging characteristics of a material. Tests are either performed by measuring the relative reflectance of a glass plate or by gravimetric analysis of the condensate. Both methods are covered by DIN 75201 which is the norm most Zotefoams products have been assessed against.

DIN 75201 Method A describes the reflectance method. Fogging behaviour is determined by measuring the reflectance from a glass plate at 60° and reporting the reflectance of a glass plate with fogging condensate as a percentage of the reflectance of the clean glass plate. Samples are kept for 3 hours at 100 °C for this test. Other examples for reflectance measurements that some Zotefoams materials have been tested to are the Volkswagen standard PV3920 and the Toyota standard TSM0503G Method B.

DIN 75201 Method B describes the reflectance method. The mass of condensable components on an aluminium foil is measured after the sample was held at 100℃ for 16 hours. Other examples for gravimetric measurements that some Zotefoams materials have been tested to are the Volkswagen standard PV3015, the General motors standard GME 60326 Method A and the Toyota Standard TSM0503G Method B.

A material that does not cause fogging will produce a value of 100% in the reflectance test and zero mass in the gravimetric analysis. Results for testing to the mentioned standards are listed below. Zotefoams products usually perform much better in these tests when compared to similar chemical blown foams. This is due to the utilisation of nitrogen as a blowing agent in Zotefoams materials which results in a pure and clean foam compared to various chemical agents in the chemical blown foams residues of which are often cause for poor fogging performance.

Material	Method A [%]	Method B [mg fog deposit]
Plastazote® HD30 Black	98	0.60
Plastazote® LD15 Black	99	0.24
Plastazote® LD15 FM	100	0.74
Plastazote® LD24 Black	99	0.10
Plastazote® LD24 FM	95	1.02
Plastazote® LD24 FR	82	0.60
Plastazote® LD30		0.10
Plastazote® LD33 FM	90	1.75
Plastazote® LD45 Black		0.10
Plastazote® MP15 FR	100	0.28
Plastazote® MP24 Black		0.00
Plastazote® MP45 Blue		0.10
Plastazote® MP45 Black		0.20
Propozote® PPA30 Black		0.30
Chemically blown crosslinked PE foam		0.70

Table 1 Test results for testing to DIN 75201

Material	Volkswagen PV3920 [%]	Volkswagen PV3015 [mg fog deposit]	General Motors GME60326A [mg fog deposit]	Toyota TSM0503G B [%] / [mg fog deposit]
Plastazote® HD30 Black	99			
Plastazote® LD24 FM			0.92	
Plastazote® LD24 FR	98.5			
Plastazote® LD29		0.09		
Plastazote® LD33		0.13		
Plastazote® LH30 Black		6.5		
Plastazote® MD50 Black				100/ 0.10
Supazote® EM 26		0.39		

Table 2 Test results for testing to manufacturers standards

ODOUR

Volatile chemical additives that are responsible for fogging of the windscreen also cause a distinct odour. This is often referred to as “new car smell”. While for some people this smell is part of the experience of driving a new car others may find this smell obnoxious. To limit the negative effects of odours caused by new materials car manufacturers have created test methods to rate the odour of materials. For this test samples are usually heated in a sealed vessel for a certain time, then cooled to room temperature before having test persons smell and rate the odour on a scale from 1 (imperceptible) to 6 (intolerable). Final scores are based on an average score from at least three examiners. Zotefoams materials have been tested to the Volkswagen standard PV 3900 C3 and VDA 270 C3 and results are listed below.

Material	Volkswagen PV3900 C3	VDA 270 C3
Plastazote® HD30 Black	3.0	
Plastazote® LD15 Black	2.5	3-4
Plastazote® LD15 FM	3.0	3
Plastazote® LD24 Black	2.5	3-4
Plastazote® LD24 FM		3-4
Plastazote® LD29	3.0	
Plastazote® LD30 Black	3.5	4
Plastazote® LD33 Black	3.0	
Plastazote® LD33 FM	4.0	
Plastazote® LD45 Black	2.5	3-4
Plastazote® LD60 Black		3
Propozote® PPA30 Black	3.0	
Supazote® EM26	3.0	
Chemically blown crosslinked PE foam 30 kg/m^3	6.0	

Table 3 Odour scores

ANALYSIS OF ORGANIC COMPOUNDS

Fogging and Odour are often caused by volatile organic compounds. To reduce both of these the chemicals causing them need to be identified. Such analysis can either be carried out as a volatile organic content (VOC) analysis or total organic content (TOC) analysis. The quantity and identity of the organic compounds are usually investigated by gas chromatography and mass spectrometry (GC-MC). Results for TOC measurements according to Volkswagen PV3341 and VDA 277 as well as VOC measurements according to VDA 278 are given in the table below.

Material	Volkswagen PV3341 [µg C/g sample]	VDA 277 [µg C/g sample]	VDA 278 (VOC) [ppm]
Evazote® VA35 Black	1		
Plastazote® HD30 Black	4		
Plastazote® LD15 Black		1.4	
Plastazote® LD15 FM		1.6	
Plastazote® LD24	3.7	1.5	278
Plastazote® LD24 FM		2.6	
Plastazote® LD24 FR	1.7		
Plastazote® LD29	5.8		
Plastazote® LD30		1.5	235
Plastazote® LD33	6.2		
Plastazote® LD45		2.5	387
Plastazote® LD45 FR	1		
Plastazote® LD60			386
Plastazote® MP24 Black	2.3		
Propozote® PPA30 Black	2.8		
Propozote® PPA30 White	2		
Supazote® EM26	2.9		

Table 4 Analysis of volatile organic compounds

FLAMMABILITY

Within the automotive industry flammability is often tested to the FMVSS302 specification. This standard describes a horizontal burn tests and specifies a maximum flame spread rate of no more than 100 mm/min for samples no thicker than 12.5 mm. More information about this test in general can be found on our technical information sheet TIS 12 and specific information on the minimum thickness required to meet the 100 mm/min flame spread requirement on the individual property datasheets of materials.

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