ILK Dresden

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Compatibility of Vespel® SP1 with C_3F_8

Customer	CERN
Order No.	CA 1334564
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Material and methods

The compatibility of Vespel® SP1 with octafluorpropane has to be tested in sealed container test. Shouldered test bars of the material were provided by the customer.
Weight after 30 min tempering at 60°C, dimensions, and Shore D hardness of the specimen were determined before storage in a 1 l sealed container. The container was closed, evacuated, and filled with 145 g octafluorpropane.

The sealed containers were tempered for 500 h at 60°C, which results in approximately 20 bar pressure.

After tempering the octafluorpropane was analysed by gas chromatography. The volatile contaminations were determined by GC-MS. The analyses were carried out using a HP 6890 system with mass sensitive detector MSD 5973.

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The samples were injected with a gas loop. Following temperature programme was used: 5 min 50°C, 20 K/min until 180°C, 1 min 180°C. For the separation a 30 m capillary column J&W US3273715H GS-GASPRO was used.
After removing octafluorpropane the specimen were weighed, tempered for 30 min at 60°C, weighed again and measured.

Results

1. Optical valuation

Visible changes of the specimen were not detected.
Sediments were not found in the container.

2. Analyses

The gas chromatogram of octafluorpropane is given in fig. 1. Details can be found in fig. 2 and 3. Besides a main peak at retention time of 2.95 respectively 3.25 min there are four smaller peaks. They are related to:

1.	air	RT 1.3 min
2.	CO_2	RT 1.8 min
3.	octafluorpentane	RT 7.8 min
4.	not identified	RT 7.9 min (Since masses of CHF_2- und CF_3- were detected in the mass spectrum the substance is a fluorocarbon.)

The total amount of impurities is less than 0.01 %. Fluorocarbons are caused by production.

3. Changes in weight and dimensions

The results of weighting are given in the following table. The weight loss of the test bars was approximately 0.1%. Differences in length, width and thickness were not detected.

Table 1: Weights of specimen before and after sealed container tests

Sample No.	before sealed container test	immediately after sealed container test	after 30 min tempering at 60°C	Weight difference
	[g]	[g]	[g]	[%]
1	1,6671	1,6669	1,6656	- 0,09
2	1,6750	1,6747	1,6733	- 0,10
3	1,6779	1,6780	1,6764	- 0,09
4	1,6767	1,6765	1,6752	- 0,09
5	1,6674	1,6670	1,6658	- 0,10
6	1,6643	1,6640	1,6624	- 0,11
7	1,6752	1,6750	1,6736	- 0,10

4. Shore hardness and tensile tests

The results of Shore D hardness (DIN 53505) are listed in the following table. Both, before and after testing in C_3F_8 the hardness of the samples is 83 Shore D.

The tensile tests were carried out on a Shimadzu test machine AG-100kNG according to EN ISO 527 Parts 1 and 2 with shouldered test bars (type 1BA) at room temperature with 10 mm/min test speed. The results for tensile strength σ_m and elongation ε_B are given in table 3.
The untreated specimens have an average tensile strength of 90.7 MPa with 4.1 MPa standard deviation. The elongation at fracture was 12.5% with 1.4% standard deviation.
The specimens from the autoclave tests have an average tensile strength of 94.1 MPa with 2.0 MPa standard deviation and an elongation of 12.9% with 0.8% standard deviation.

Table 2: Shore hardness of specimen before and after sealed container tests

sample No.	before sealed container test	after sealed container test
1	83	83
2	83	83
3	83	83
4	83	83
5	83	83
6	83	83
7	83	83

Table 3: Tensile strength and elongation of specimen before and after sealed container tests

sample No.	before sealed container test		after sealed container test	
	σ_m [MPa]	ε_B [%]	σ_m [MPa]	ε_B [%]
1	90,28	11,72	96,15	13,18
2	93,01	13,01	95,56	12,97
3	82,97	9,94	92,2	12,26
4	96,33	13,75	96,06	13,58
5	89,7	13,01	94,18	13,53
6	90,01	12,03	93,75	13,38
7	92,74	14,21	91,06	11,55

Conclusions

There were no changes besides a small decrease in weight. There is no significant difference in mechanical properties of the specimen before and after sealed container test.
On test conditions given above Vespel® SP1 shows an excellent resistance against octafluorpropane.

Dipl.-Chem. M. Knabe
Responsible co-worker

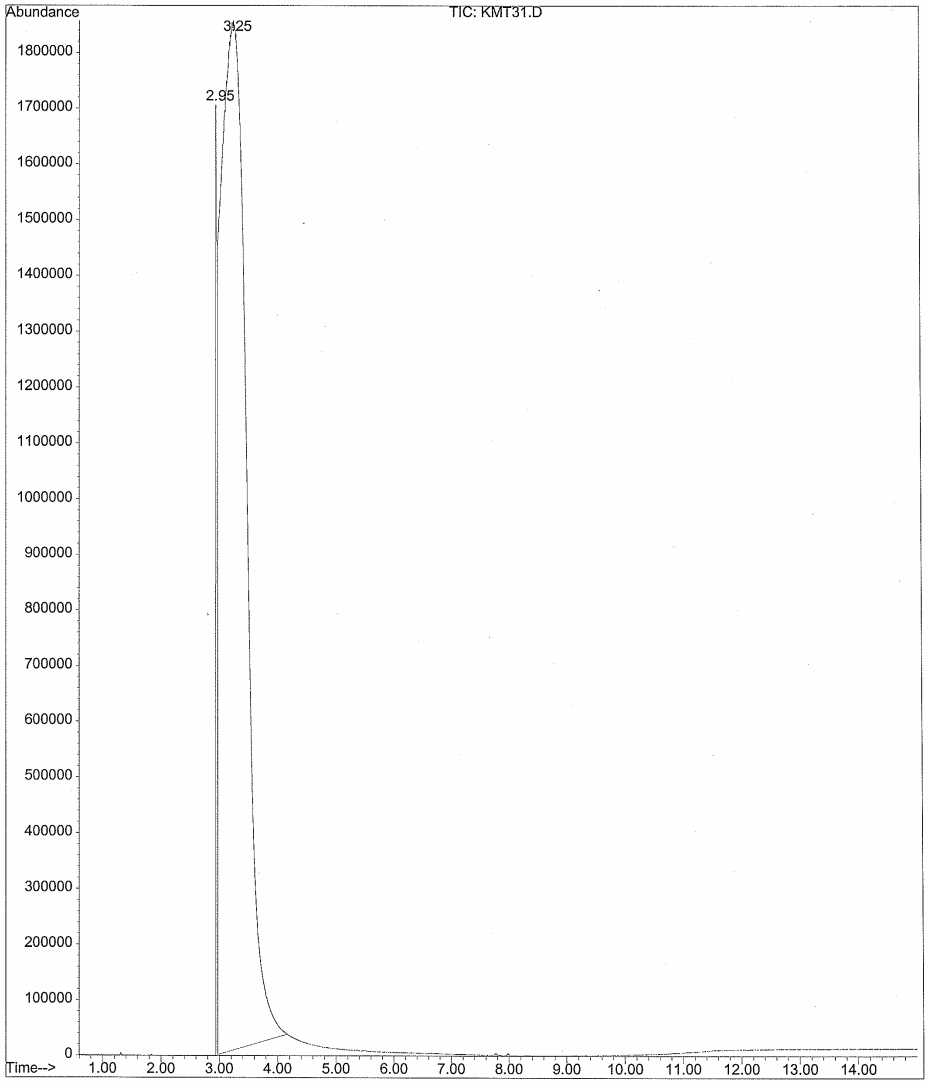
Dr.-Ing. M. Junk
Responsible co-worker

Area Percent Report

Data File : C:\HPCHEM\1\DATA\KMT31.D
Acq On : 23 Aug 04 12:22 pm
Sample : Autoklav Cern
Misc :

Vial: 1
Operator: kn
Inst : GC/MS Ins
Multiplr: 1.00
Sample Amount: 0.00

MS Integration Params: events.e
Method : C:\HPCHEM\1\METHODS\HFKWN2.M (Chemstation Integrator)
Title : detar



KMT31.D HFKWN2.M Mon Aug 23 12:43:46 2004

Fig. 1: Gas chromatogram of octafluorpropane

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Operator    : kn
Acquired    : 23 Aug 04  12:22     using AcqMethod HFKWN2
Instrument :   GC/MS Ins
Sample Name: Autoklav Cern
Misc Info   :
Vial Number: 1
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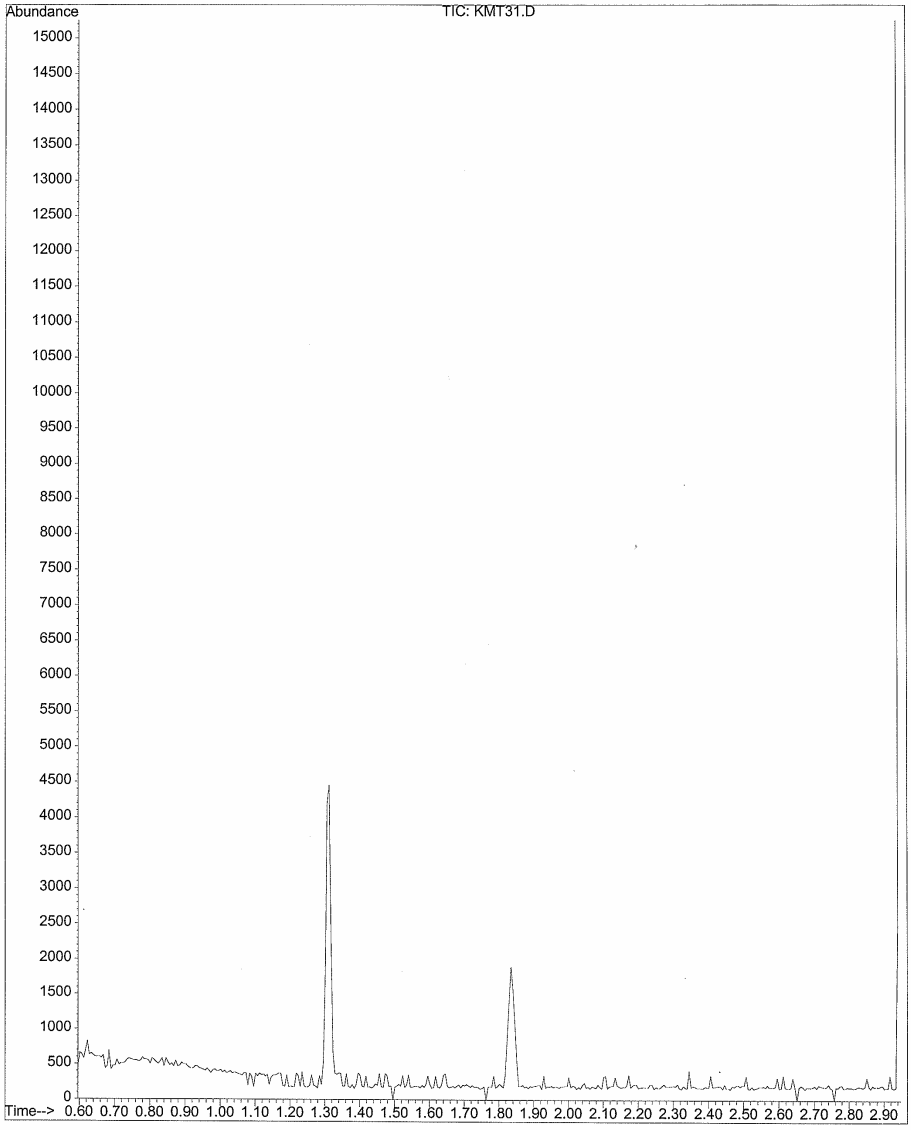

Fig. 2: detail from fig. 1

```
File        : C:\HPCHEM\1\DATA\KMT31.D
Operator    : kn
Acquired    : 23 Aug 04  12:22     using AcqMethod HFKWN2
Instrument :   GC/MS Ins
Sample Name: Autoklav Cern
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Vial Number: 1
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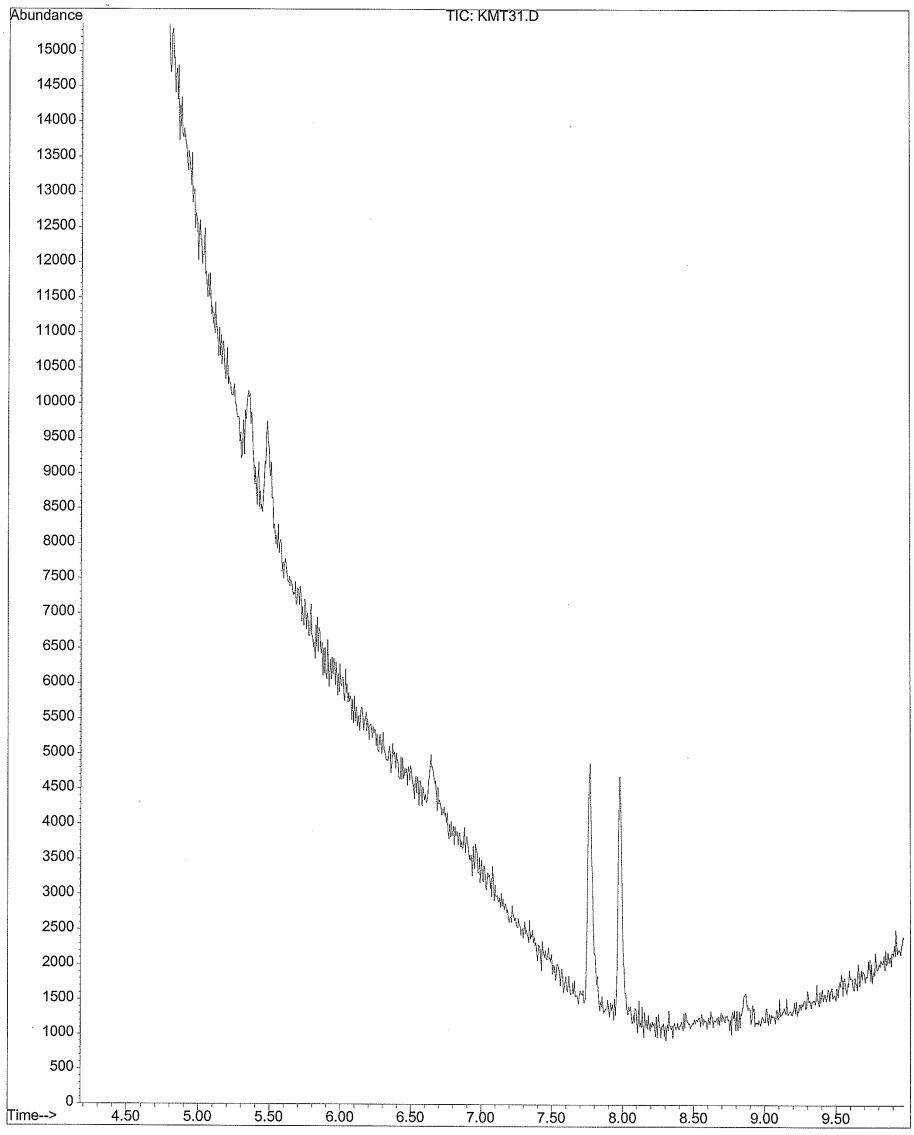

Fig. 3: detail from fig. 1

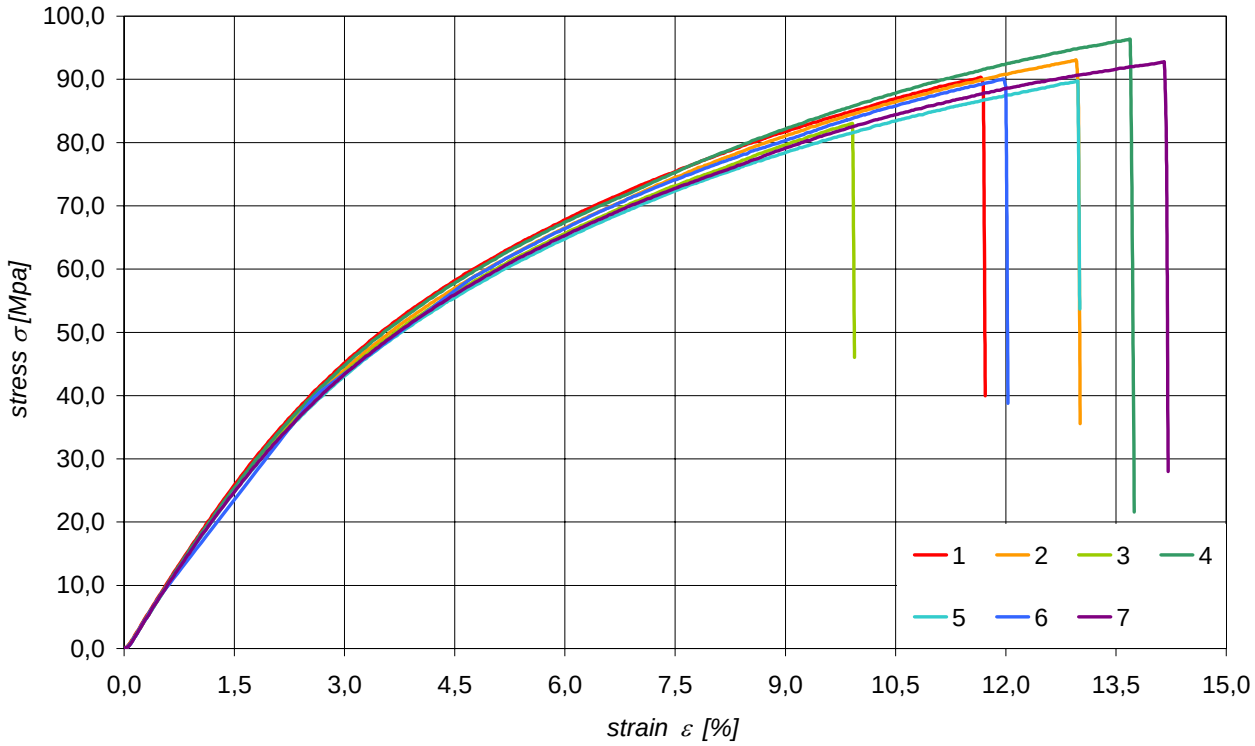

Fig. 4: stress-strain-diagram of Vespel® SP1

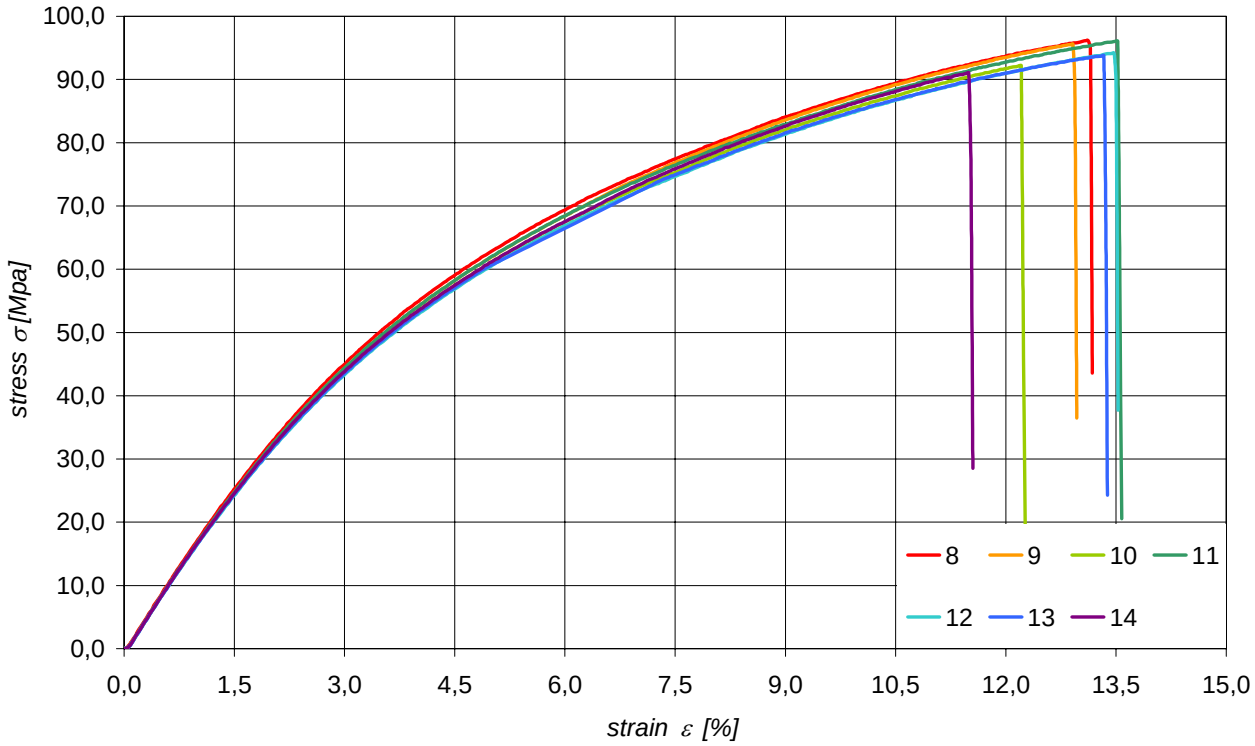

Fig. 5: stress-strain-diagram of Vespel® SP1 after sealed container test