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OUTGASSING TEST OF A GORE-TEX RIBBON

Code:
VIR-TRE-PIS-3400-116


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	Gore ribbon	Doc: VIR-TRE-PIS-3400-116 code Issue: 1 Date: 21/04/1997 Page: 2
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CHANGE RECORD

<i>Issue/Rev</i>	<i>Date</i>	<i>Section affected</i>	<i>Reason/ remarks</i>

Authors: M. Bernardini R. Poggiani	Date 	Signature 
Approved by: 		


 The logo for VIRGO, featuring a stylized circular symbol composed of several curved lines above the word "VIRGO" in a bold, sans-serif font.	Gore ribbon	Doc: VIR-TRE-PIS-3400-116 code Issue: 1 Date: 21/04/1997 Page: 3
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In this note we briefly report the results obtained a ribbon manufactured by Gore, USA.
The measurement method is described in detail in VACPISA 025.



1 - System performances

We performed a baking of the test chamber at 250 °C for 5 days and we got:

t(h)	T(°C)	p ₁ (mbar)	p ₂ (mbar)	Q(mbar l/s)
after	33	8.9x10 ⁻¹⁰	2.9x10 ⁻¹⁰	1.2x10 ⁻⁸

The main components of outgassing after baking were H₂, H₂O, N₂/CO, CO₂.
The internal surface of the chamber is 3200 cm².

2 - Measurement of the outgassing flow of Goretex ribbon

The experimental sample was a Gore-tex+PTFE ribbon AX with four conductors. We connected the four conductors in series achieving a total resistance of 63.3 Ω. The exposed surface of cabling was 3900 cm². The ribbon was cleaned in an ultrasonic bath of isopropyl alcohol for 15 minutes then baked in air at 100 °C for four days.

We monitored the evolution of outgassing (time is measured from beginning of the test through the whole paper):

t(h)	T(°C)	p ₁ (mbar)	p ₂ (mbar)	Q(mbar l/s)
18	25	8.2x10 ⁻⁷	1.5x10 ⁻⁷	1.3x10 ⁻⁵
40.5	25	1.6x10 ⁻⁷	3.0x10 ⁻⁸	2.6x10 ⁻⁶
69.5	23	7.7x10 ⁻⁸	1.3x10 ⁻⁸	1.3x10 ⁻⁶
93	25	5.4x10 ⁻⁸	9.4x10 ⁻⁹	8.9x10 ⁻⁷
160.5	25	2.5x10 ⁻⁸	4.4x10 ⁻⁹	4.1x10 ⁻⁷
185	25	2.9x10 ⁻⁸	4.3x10 ⁻⁹	4.9x10 ⁻⁷
212.25	23	2.0x10 ⁻⁸	3.5x10 ⁻⁹	3.3x10 ⁻⁷

The spectrum taken after 212.5 hours is shown in Fig. 1. We checked that the peak at 32 was not due to a leak.

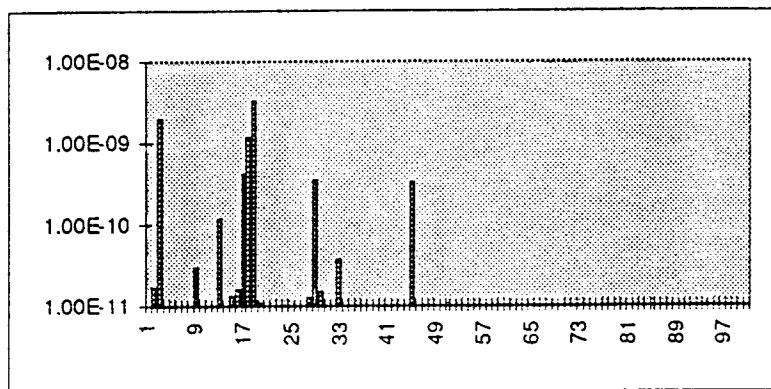


Fig. 1 Outgassing spectrum after 212.25 hours pumping at room temperature

We set temperature to 50 °C and monitored the evolution of outgassing:

t(h)	T(°C)	p ₁ (mbar)	p ₂ (mbar)	Q(mbar l/s)
212.5	44	4.2x10 ⁻⁷	7.5x10 ⁻⁸	6.9x10 ⁻⁶
212.75	80	6.1x10 ⁻⁶	9.3x10 ⁻⁷	1.0x10 ⁻⁴
213	80	2.3x10 ⁻⁵	2.1x10 ⁻⁶	4.2x10 ⁻⁴
231.5	60	9.4x10 ⁻⁸	1.5x10 ⁻⁸	1.6x10 ⁻⁶
238.5	65	1.6x10 ⁻⁷	2.7x10 ⁻⁸	2.7x10 ⁻⁶
256	60	1.2x10 ⁻⁷	1.9x10 ⁻⁸	2.0x10 ⁻⁶
260.5	60	1.0x10 ⁻⁷	1.7x10 ⁻⁸	1.7x10 ⁻⁶

The spectrum measured after 260.5 hours is shown in Fig. 2.

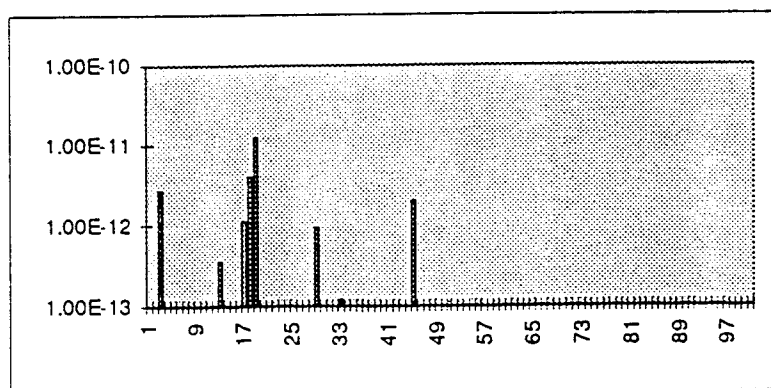


Fig. 2 Outgassing spectrum after 48 hours at 50 °C

We set the temperature at 100 °C and we measured:

t(h)	T(°C)	p ₁ (mbar)	p ₂ (mbar)	Q(mbar l/s)
260.75	80	5.5x10 ⁻⁶	9.5x10 ⁻⁷	9.1x10 ⁻⁵
261	90	2.2x10 ⁻⁵	3.9x10 ⁻⁶	3.6x10 ⁻⁴
261.25	105	4.5x10 ⁻⁵	7.7x10 ⁻⁶	7.5x10 ⁻⁴
262	107	2.9x10 ⁻⁶	5.2x10 ⁻⁷	4.8x10 ⁻⁵
262.5	96	8.4x10 ⁻⁷	1.4x10 ⁻⁷	1.4x10 ⁻⁵
328.5	100	1.7x10 ⁻⁷	2.6x10 ⁻⁸	2.9x10 ⁻⁶
333.5	100	1.7x10 ⁻⁷	2.7x10 ⁻⁸	2.9x10 ⁻⁶

The spectrum measured after 333.5 hours is shown in Fig. 3.

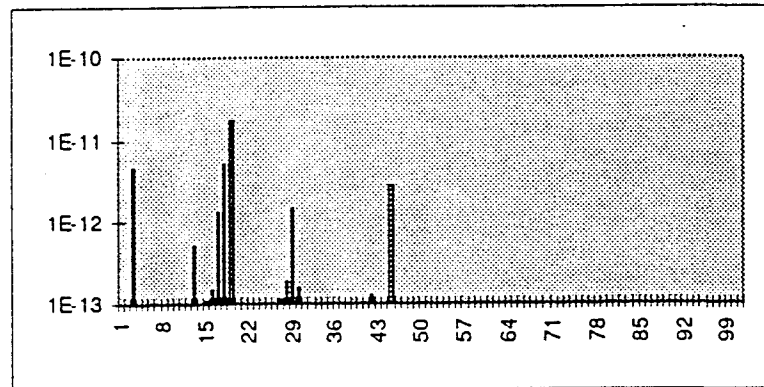


Fig. 3 Outgassing spectrum after 73 hours at 100 °C

We set temperature to 150 °C and we measured:

t(h)	T(°C)	p ₁ (mbar)	p ₂ (mbar)	Q(mbar l/s)
333.75	120	2.3x10 ⁻⁷	3.8x10 ⁻⁸	3.8x10 ⁻⁶
334	132	2.1x10 ⁻⁶	3.4x10 ⁻⁷	3.5x10 ⁻⁵
334.25	160	6.6x10 ⁻⁶	1.0x10 ⁻⁶	1.1x10 ⁻⁴
334.5	150	1.8x10 ⁻⁶	3.2x10 ⁻⁷	3.0x10 ⁻⁵
334.75	165	6.9x10 ⁻⁶	1.1x10 ⁻⁶	1.2x10 ⁻⁴
336	150	2.2x10 ⁻⁶	3.4x10 ⁻⁷	3.7x10 ⁻⁵
352	150	4.7x10 ⁻⁷	1.6x10 ⁻⁷	1.7x10 ⁻⁵
356.5	150	1.6x10 ⁻⁷	2.7x10 ⁻⁸	2.7x10 ⁻⁶
357	150	2.7x10 ⁻⁷	4.2x10 ⁻⁸	4.6x10 ⁻⁶



357.75	150	1.4×10^{-7}	2.4×10^{-8}	2.3×10^{-6}
358	150	5.0×10^{-7}	7.5×10^{-8}	8.5×10^{-6}
358.25	170	9.8×10^{-7}	1.4×10^{-7}	1.7×10^{-5}
377.5	150	6.5×10^{-7}	8.9×10^{-8}	1.1×10^{-5}
383.25	150	1.3×10^{-7}	2.1×10^{-8}	2.2×10^{-6}

In the morning we found the gauges off; no air entered in the system and in half an hour the vacuum came back to the above level.

423	150	6.6×10^{-8}	1.2×10^{-8}	1.1×10^{-6}
429.75	150	1.3×10^{-7}	2.1×10^{-8}	2.2×10^{-6}

The spectrum measured after 429.75 hours is shown in Fig. 4. The fluctuations in the outgassing were caused by an imperfect functioning of heating system.

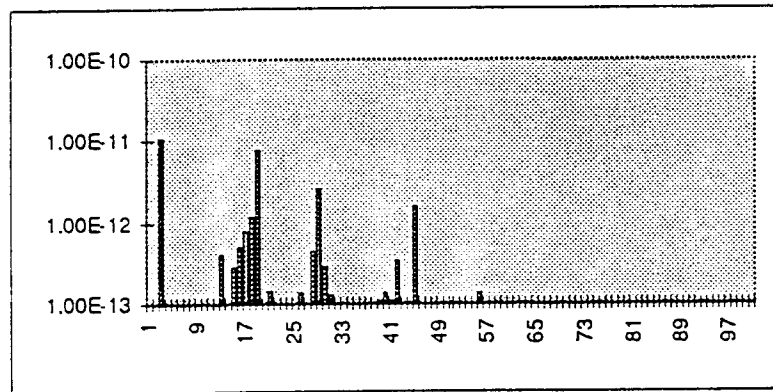


Fig. 4 Outgassing spectrum after 96 hours at 150 °C

We switched off the heating and we measured:

t(h)	T(°C)	p ₁ (mbar)	p ₂ (mbar)	Q(mbar l/s)
430.25	127	4.1×10^{-8}	7.9×10^{-9}	6.6×10^{-7}
430.5	113	2.5×10^{-8}	5.5×10^{-9}	3.9×10^{-7}
430.75	105	1.9×10^{-8}	4.5×10^{-9}	2.9×10^{-7}
497.5	25	5.4×10^{-10}	2.8×10^{-10}	5.2×10^{-9}
500	25	8.9×10^{-10}	3.4×10^{-10}	1.1×10^{-8}
520	25	7.3×10^{-10}	3.4×10^{-10}	7.8×10^{-9}

The spectrum measured after 544.5 hours is shown in Fig. 5.

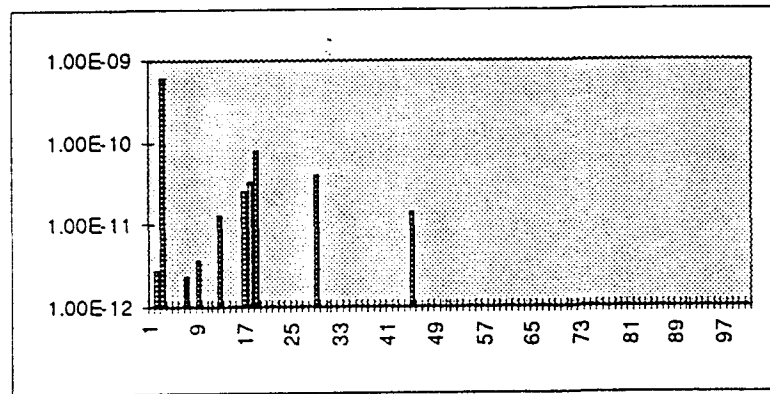


Fig. 5 Outgassing spectrum after vacuum baking at 150 °C

We tested the cables with current flowing. We supplied 200 mA (~2 W dissipation) for two days with a small increase in outgassing. The outgassing composition during the current test is shown in Fig. 6.

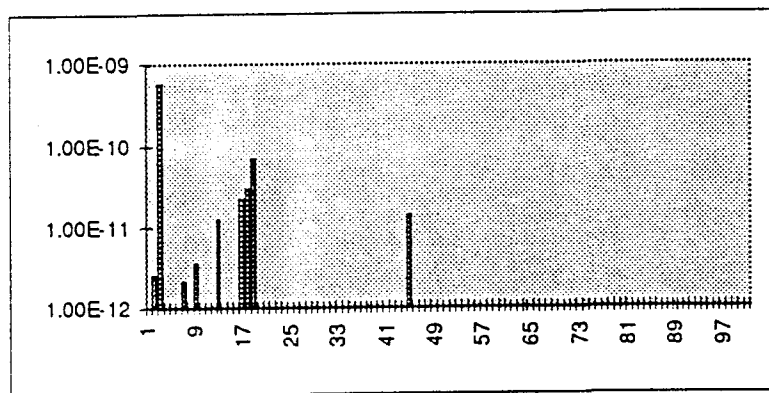


Fig. 6 Outgassing composition during 100 mA supplying

A short test with 400 mA (~9 W dissipation) caused an increase of less than order of magnitude in the outgassing.

The outgassing rate evolution is summarized in Fig. 7.

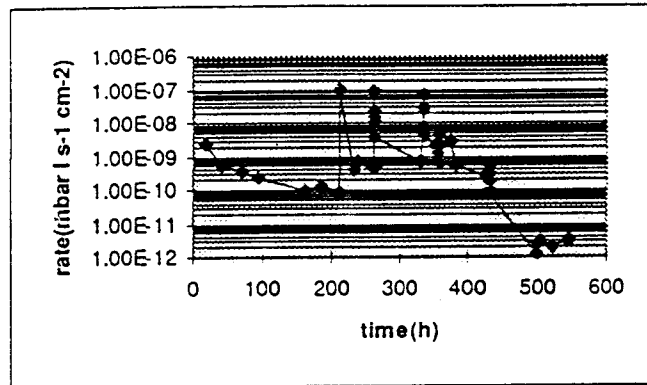


Fig. 7 Time evolution of the outgassing rate

3 - Discussion

The outgassing rate of the Goretex cabling after baking at 150 °C was $\sim 10^{-12}$ mbar l s⁻¹ cm⁻². We did not observe any sizable contamination neither at room temperature nor at 50, 100, 150 °C or when current was flowing the cables. We can thus conclude that the cables can be recommended for use in VIRGO.