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OUTGASSING TEST OF A LOUDSPEAKER MAGNET

Code:
VIR-TRE-PIS-3400-118

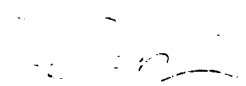
Date: 21/04/1997

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	Loudspeaker magnet	Doc: VIR-TRE-PIS-3400-118 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 representation of a spiral or wave pattern above the word "VIRGO" in a bold, sans-serif font.	Loudspeaker magnet	Doc: VIR-TRE-PIS-3400-118 code Issue: 1 Date: 21/04/1997 Page: 3
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In this note we briefly report the outgassing measurements performed with a loudspeaker magnet. 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 some days and we got:

t(h)	T(°C)	p ₁ (mbar)	p ₂ (mbar)	Q(mbar l/s)
after	25	3.1x10 ⁻⁸	4.8x10 ⁻⁹	5.2x10 ⁻⁷

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 rate of the magnet

The experimental sample was a loudspeaker magnet for which no information was available. The magnet was an hollow cylinder mounted on a metal frame and fixed with an unknown glue. We attempted cleaning the first samples by a baking at 150°C for some days: the glue was burnt. The final sample was cleaned by baking at 80°C for several hours. The exposed surface of the magnets was 30.8 cm².

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)
0.5	25	1.6x10 ⁻⁵	1.9x10 ⁻⁶	2.8x10 ⁻⁴
1.25	25	9.4x10 ⁻⁶	1.0x10 ⁻⁶	1.7x10 ⁻⁴
1.5	25	7.0x10 ⁻⁶	7.9x10 ⁻⁷	1.2x10 ⁻⁴
2	25	5.2x10 ⁻⁶	6.0x10 ⁻⁷	9.2x10 ⁻⁵
2.5	25	3.8x10 ⁻⁶	4.4x10 ⁻⁷	6.7x10 ⁻⁵
66.5	23	9.7x10 ⁻⁸	1.2x10 ⁻⁸	1.7x10 ⁻⁶
71	23	1.7x10 ⁻⁷	2.1x10 ⁻⁸	3.0x10 ⁻⁶
73	23	1.6x10 ⁻⁷	2.0x10 ⁻⁸	2.8x10 ⁻⁶
90.5	23	1.2x10 ⁻⁷	1.5x10 ⁻⁸	2.1x10 ⁻⁶
94.5	23	1.3x10 ⁻⁷	1.6x10 ⁻⁸	2.3x10 ⁻⁶
96.75	23	1.1x10 ⁻⁷	1.5x10 ⁻⁸	1.9x10 ⁻⁶
97.5	23	1.2x10 ⁻⁷	1.6x10 ⁻⁸	2.1x10 ⁻⁶
114.5	23	8.8x10 ⁻⁸	1.1x10 ⁻⁸	1.5x10 ⁻⁶
119.5	23	1.2x10 ⁻⁷	1.4x10 ⁻⁸	2.1x10 ⁻⁶

The spectrum taken after 114.5 hours is shown in Fig. 1.

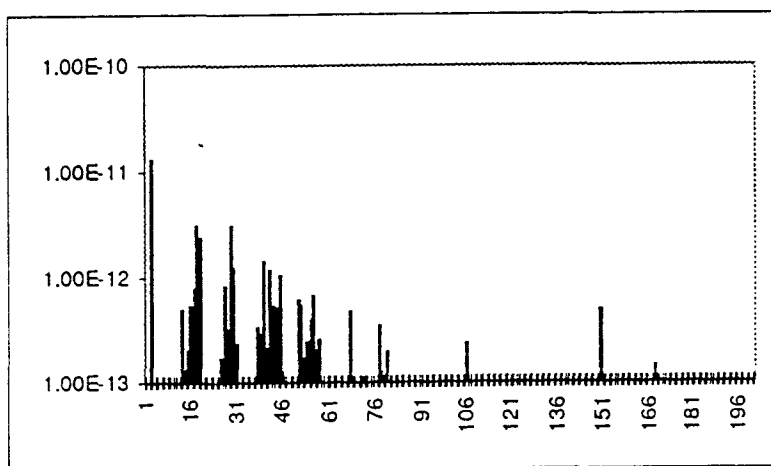


Fig. 1 Outgassing spectrum after 114.5 hours pumping at room temperature

There is evidence of several organic fragments (around 40, around 50 and above).

We set temperature at 50 °C for 71 hours and monitored the evolution of outgassing:

t(h)	T(°C)	p ₁ (mbar)	p ₂ (mbar)	Q(mbar l/s)
120	58	4.1x10 ⁻⁶	4.1x10 ⁻⁷	7.4x10 ⁻⁵
120.25	80	1.0x10 ⁻⁶	1.0x10 ⁻⁷	1.8x10 ⁻⁵
120.5	70	6.8x10 ⁻⁷	7.7x10 ⁻⁸	1.2x10 ⁻⁵
120.75	60	5.6x10 ⁻⁷	6.7x10 ⁻⁸	9.9x10 ⁻⁶
121	54	5.3x10 ⁻⁷	6.2x10 ⁻⁸	9.4x10 ⁻⁶
121.5	50	5.1x10 ⁻⁷	6.0x10 ⁻⁸	9.0x10 ⁻⁶
122	50	7.5x10 ⁻⁷	8.2x10 ⁻⁸	1.4x10 ⁻⁵
138.5	50	6.5x10 ⁻⁷	7.5x10 ⁻⁸	1.1x10 ⁻⁵
145	50	4.5x10 ⁻⁷	5.4x10 ⁻⁸	7.9x10 ⁻⁶
161	50	4.9x10 ⁻⁷	5.5x10 ⁻⁸	8.7x10 ⁻⁶
165	50	4.6x10 ⁻⁷	5.1x10 ⁻⁸	8.2x10 ⁻⁶
186.5	50	2.8x10 ⁻⁷	3.3x10 ⁻⁸	4.9x10 ⁻⁶
191	50	2.2x10 ⁻⁷	2.7x10 ⁻⁸	3.9x10 ⁻⁶

An outgassing spectrum measured at the beginning of heating is shown in Fig. 2. Another spectrum taken after 71 hours is shown in Fig. 3.

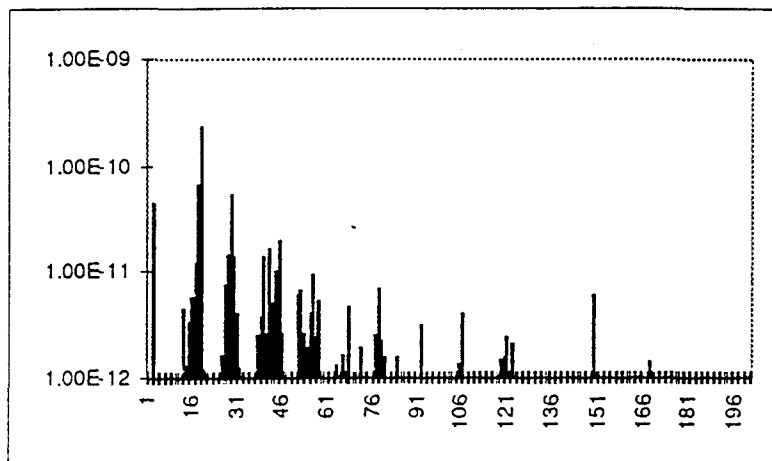


Fig. 2 Outgassing spectrum after 1 hour at 50 °C

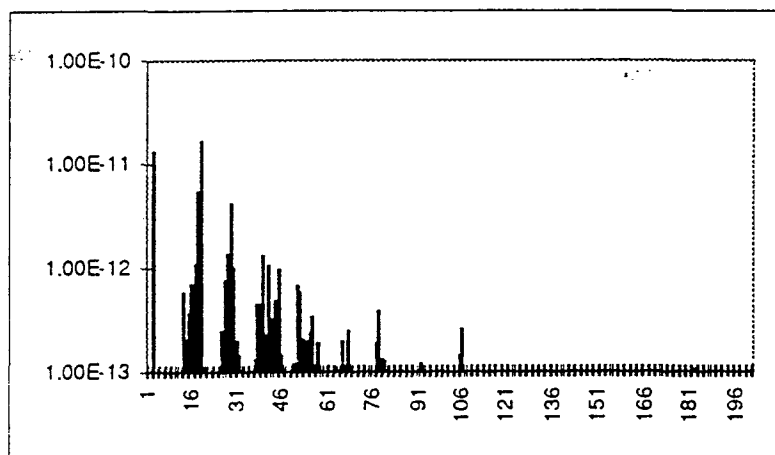


Fig. 3 Outgassing spectrum after 71 hours at 50 °C

In both cases there are again a lot of organic fragments.
 We set temperature at 80°C for 93 hours and we measured:

t(h)	T(°C)	p ₁ (mbar)	p ₂ (mbar)	Q(mbar l/s)
191.25	72	2.3x10 ⁻⁶	2.4x10 ⁻⁷	4.1x10 ⁻⁵
191.5	100	1.2x10 ⁻⁶	1.3x10 ⁻⁷	2.1x10 ⁻⁵
192.25	80	2.0x10 ⁻⁶	2.1x10 ⁻⁷	3.6x10 ⁻⁵
192.75	80	1.9x10 ⁻⁶	1.8x10 ⁻⁷	3.4x10 ⁻⁵
193.5	80	2.8x10 ⁻⁶	2.7x10 ⁻⁷	5.1x10 ⁻⁵
211.5	80	2.3x10 ⁻⁶	2.3x10 ⁻⁷	4.1x10 ⁻⁵
216	80	1.8x10 ⁻⁶	1.9x10 ⁻⁷	3.2x10 ⁻⁵
235.75	80	1.1x10 ⁻⁶	1.1x10 ⁻⁷	2.0x10 ⁻⁵



257.5	80	9.0×10^{-7}	9.4×10^{-8}	1.6×10^{-5}
283.75	80	3.7×10^{-7}	4.1×10^{-8}	6.6×10^{-6}

The spectrum measured after 93 hours at 80 °C is shown in Fig. 4.

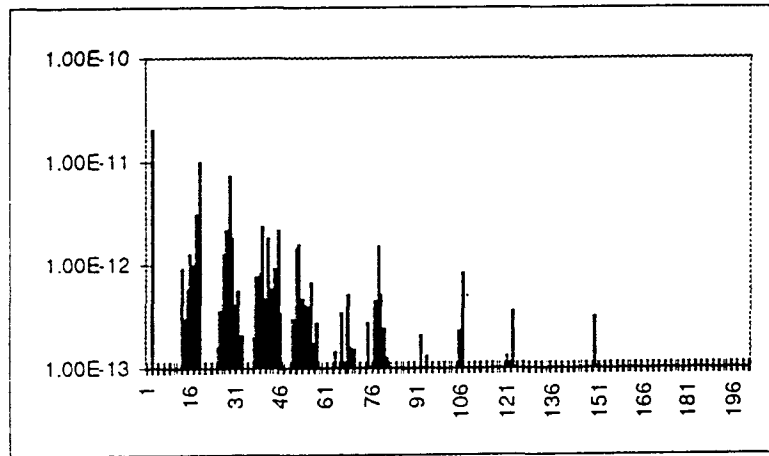


Fig. 4 Outgassing spectrum after 93 hours at 80 °C

Again there are a lot of organic fragments.
 We switched off the heating and we measured:

t(h)	T(°C)	p ₁ (mbar)	p ₂ (mbar)	Q(mbar l/s)
284.25	70	3.2×10^{-7}	3.5×10^{-8}	5.7×10^{-6}
284.5	66	2.6×10^{-7}	2.9×10^{-8}	4.6×10^{-6}
287.5	40	4.0×10^{-8}	5.7×10^{-9}	6.9×10^{-7}
354	19	2.7×10^{-9}	5.7×10^{-10}	4.3×10^{-8}

The spectrum measured after cooling down is shown in Fig. 5.

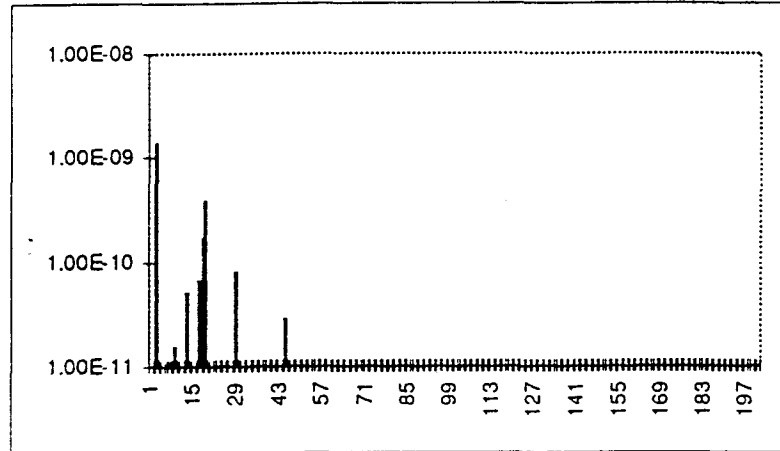


Fig. 5 Outgassing spectrum after thermal cycle

There are no more organic fragments.

The outgassing rate evolution is summarized in Fig. 6.

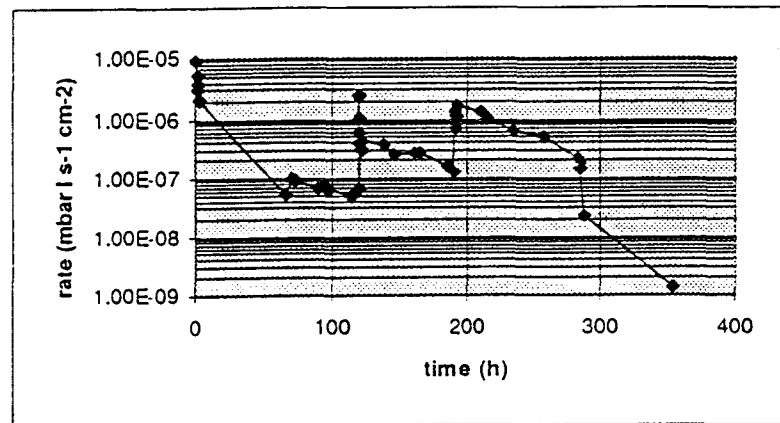


Fig. 6 Time evolution of the outgassing rate

3 - Discussion

The outgassing rate achieved after the thermal cycle was 1.4×10^{-9} mbar l s⁻¹ cm⁻². We observed several organic fragments before and during heating of the magnet. Due to this fact, we did not attempt to heat the magnet above 80 °C. The organic fragments observed during heating are mainly coming from the glue used to fix the magnet to the metal support, being the glue not specifically chosen for vacuum applications. We do not recommend this kind of magnets for use in VIRGO.