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Object: Outgassing measurements of a third AML motor

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In this note we briefly report the results obtained on a third sample of the AML motor. The test apparatus is described in detail in the note VACPISA 025. The outgassing is measured using the dynamic method: measuring both pressures in the sample chamber P_1 and in the pumping chamber P_2 the total outgassing flow can be deduced from the relation:

$$Q = (P_1 - P_2) \times C \qquad (1)$$

where C is the conductance (20 l/s N_2 equivalent at 20^0C). The measurement is performed twice, with and without the sample into the sample chamber: the difference between the two flow values will represent the net sample outgassing; the difference in the RGA spectra will give the mass distribution of the sample outgassing.

1 - System performances

After baking the base pressure of the chamber is of the order of 10^{-9} mbar and the outgassing rate of the order of 10^{-11} mbar l s^{-1} cm^{-2}. The main components of outgassing are H_2, H_20, N_2/CO, CO_2.

2 - Measurement of the outgassing flow of the motor

The motor is described in detail in the note VACPISA 025.
We put the motor under vacuum and we monitored the outgassing evolution:

t(h)	T(^{0}C)	p_1(mbar)	p_2(mbar)	Q(mbar l/s)
1	30	2.7×10^{-4}	7.0×10^{-5}	4.0×10^{-3}
1.5	30	2.4×10^{-4}	9.2×10^{-5}	3.0×10^{-3}
2	30	1.4×10^{-4}	3.5×10^{-5}	2.1×10^{-3}

2.5	30	1.1×10^{-4}	2.0×10^{-5}	1.8×10^{-3}
16	30	4.3×10^{-6}	3.6×10^{-7}	7.9×10^{-5}
18	30	4.5×10^{-6}	3.6×10^{-7}	8.3×10^{-5}
start motor operation at 0.5 A				
18.5	40	2.2×10^{-5}	1.4×10^{-6}	4.1×10^{-4}
19	40	2.8×10^{-5}	2.6×10^{-6}	5.1×10^{-4}
19.25	40	3.1×10^{-5}	3.0×10^{-6}	5.6×10^{-4}
start motor operation at 1 A				
19.5	175	6.4×10^{-5}	6.3×10^{-6}	1.2×10^{-3}
start "bake" program				
20	175	4.7×10^{-5}	5.5×10^{-6}	8.3×10^{-4}
20.25	175	4.3×10^{-5}	4.6×10^{-6}	7.7×10^{-4}
23	175	9.5×10^{-6}	7.2×10^{-7}	1.8×10^{-4}
23.5	175	7.1×10^{-6}	5.7×10^{-7}	1.3×10^{-4}
24	175	5.6×10^{-6}	4.5×10^{-7}	1.0×10^{-4}

The outgassing spectrum measured after 16h is reported in Fig. 1.

We started the baking of the chamber at 150 ^{0}C:

t(h)	p_1(mbar)	p_2(mbar)	Q(mbar l/s)
during	1.6×10^{-6}	1.3×10^{-6}	6.0×10^{-6}
after	1.6×10^{-7}	9.5×10^{-8}	1.3×10^{-6}

The outgassing spectra taken during the baking and after the baking are shown in Fig. 2, 3. During the baking there is emission of oil fragments and maybe of fluorine compounds. After the baking the motor does not present any contamination from low mass organic fragments. The time evolution of the outgassing including the baking and the motor in operation is shown in Fig. 4.

3 - Discussion

Comparing the actual data with ones in the note VACPISA025 we find that the new sample is better with respect to high mass contaminants. This effect is due to the replacement of the ethyl-lactate with 141b dichloro-fluoro-ethane. Unluckily, the solvent contains fluorine which means that in case it is not completely removed fluorine compounds fragments can be outgassed. For this reason we think that the AML motor cannot be yet recommended for use in VIRGO. We get this opportunity to stress the difficulties inherent to the

cleaning of assembled parts, even if they are small, and to the removal of solvents.

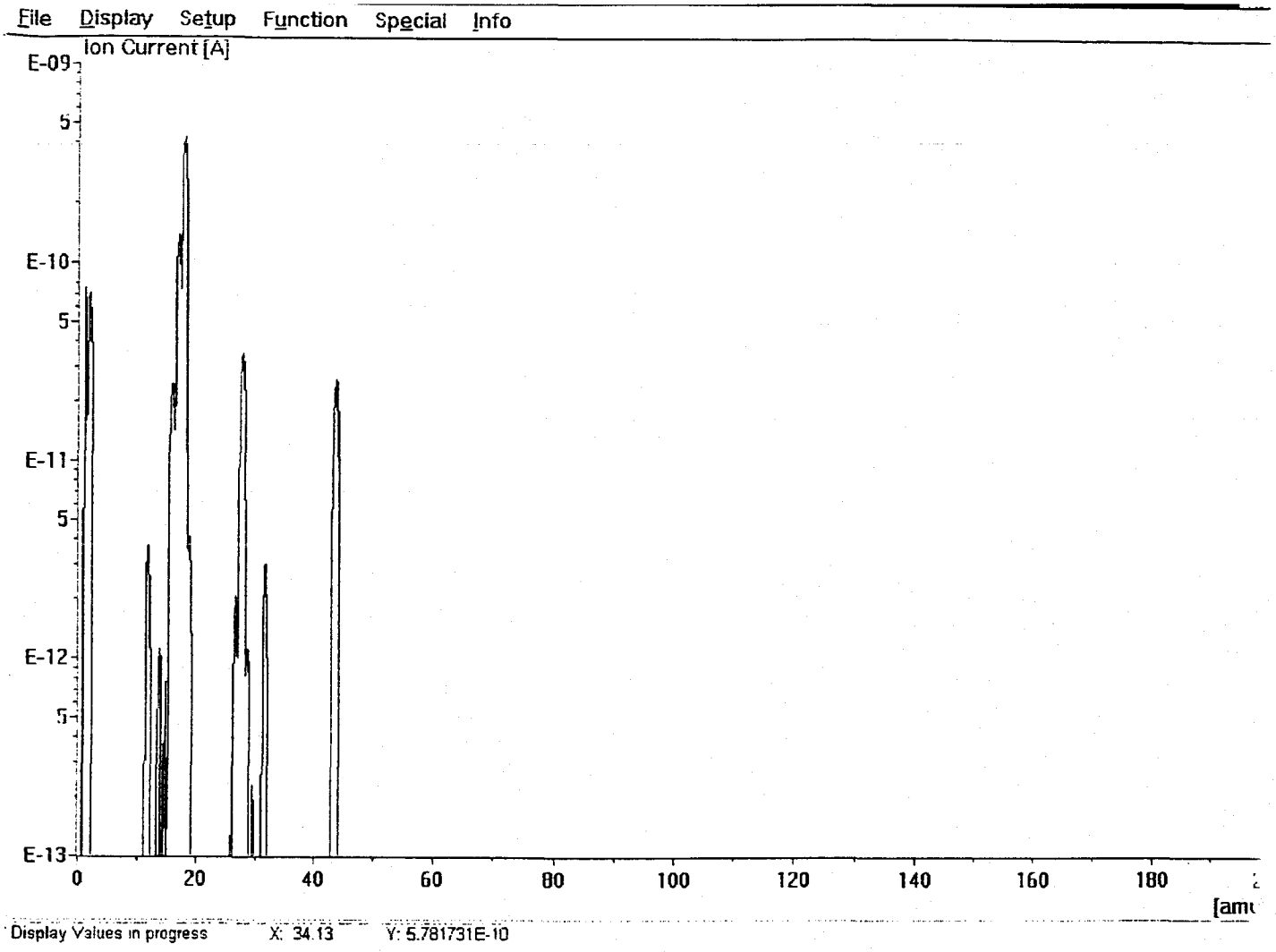
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Fig. 1

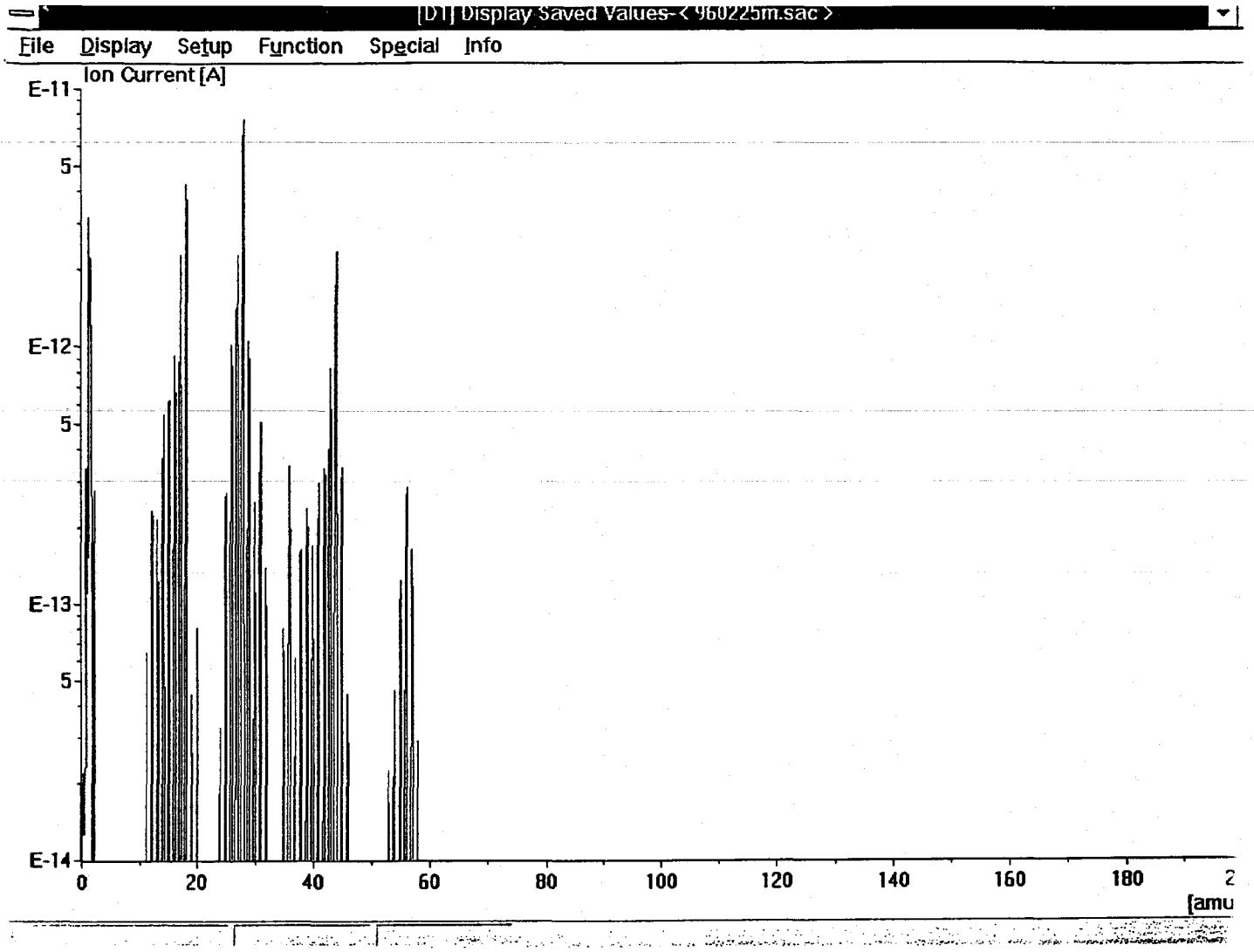
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Fig. 2

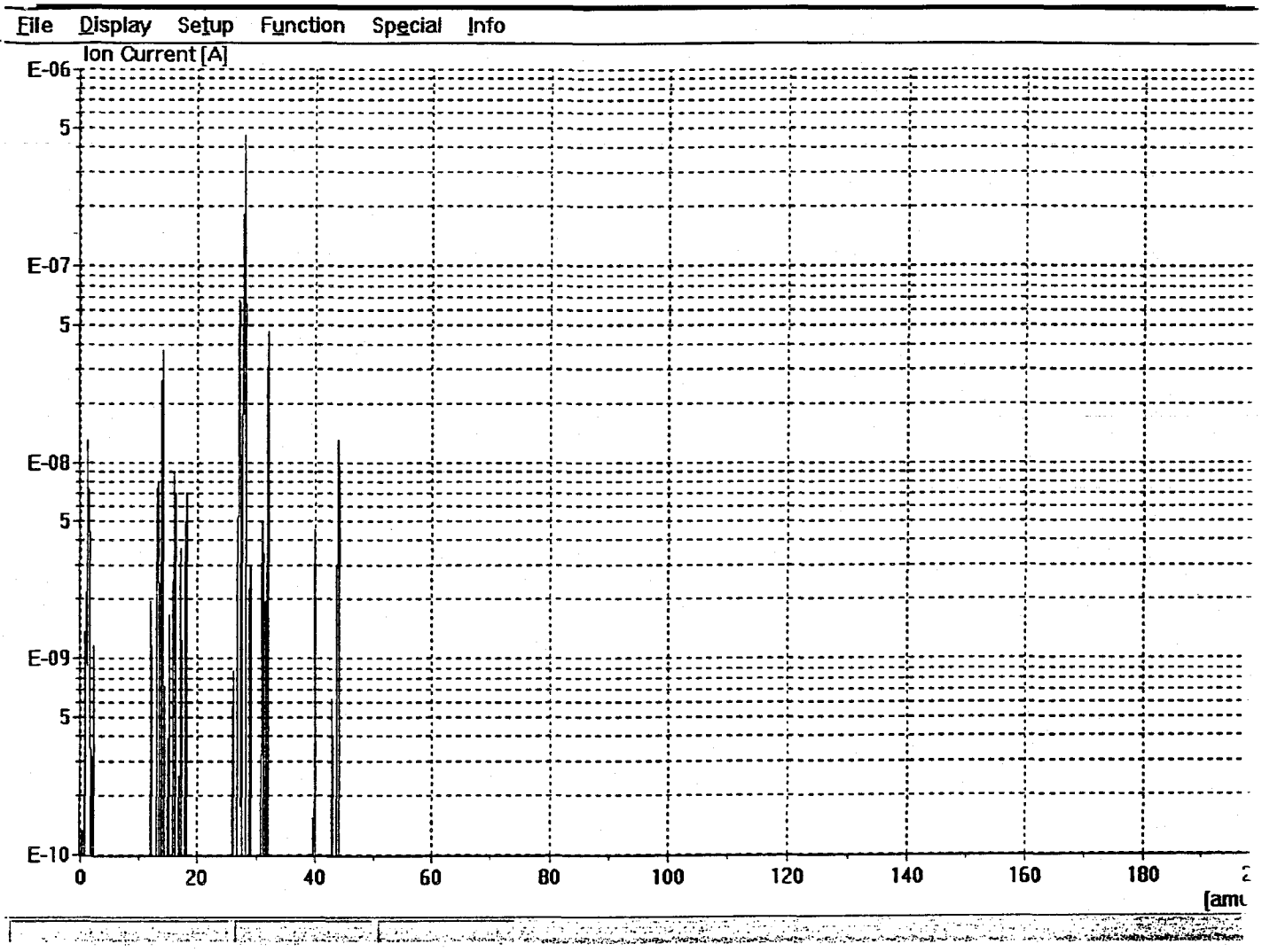
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Fig. 3

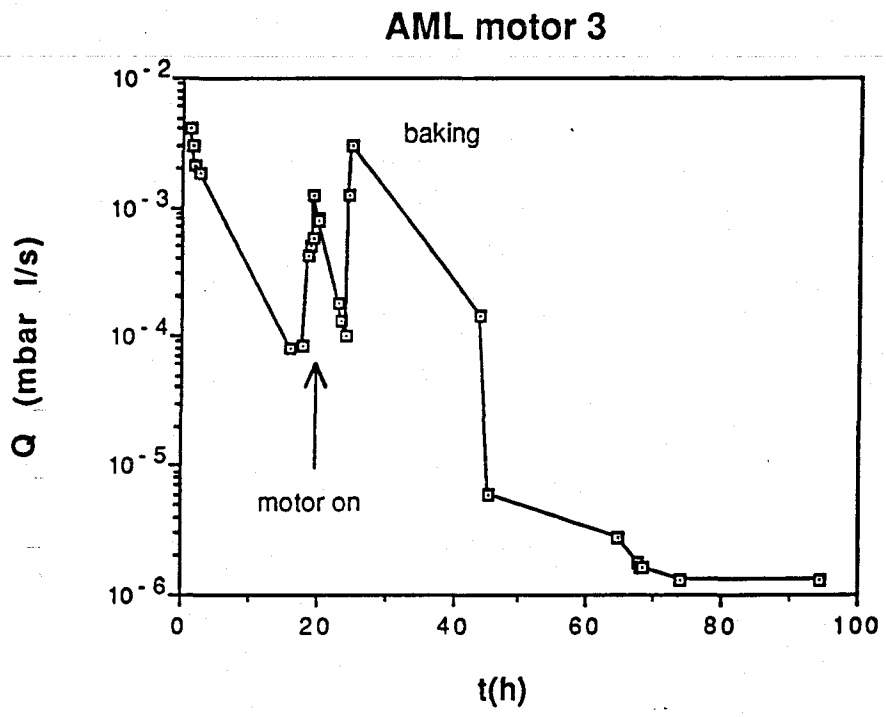
AML motor 3
Q (mbar l/s)
10 - 2
10 - 3
10 - 4
10 - 5
10 - 6
baking
motor on
0
20
40
60
80
100
t(h)

Fig. 4