CHEM*TRACE* 44050 Fremont Blvd. Fremont, CA 94538, Tel: (510) 687-8000 Fax: (510) 687-9054

Organic Outgassing Analysis by ATD GC-MS

Requestor: Jim Norberg
Company: Evans Analytical
Sample Receipt: 2/5/04
Report Date: 2/12/04

WO# 986424 (Part II of II)
PO # C04H8857

Analysis Requested:
Organic Outgassing Analysis by GC-MS at 100°C for 30 minutes.

Sample Information:
Sample ID: Wafer Carrier Material
Samples were received wrapped in foil.

Experimental:

Equipment:	Perkin-Elmer ATD-400, HP 6890 GC and HP 5973 MSD
Sample Size:	150 mg
Sample Outgassing Condition:	100°C for 30 minutes
Trap Adsorbent/Temperatures:	Tenax/-30 ^{o}C (absorption)/325 ^{o}C (desorption)
Desorption and GC Carrier Gas:	Helium
GC Capillary Column Temp:	40 °C to 280 °C

Data Processing & Calculation:

Identification:	Computer-aided search of NBSK library with 75,000 spectra and best effort manual interpretation is provided for unknowns
Semi-quantitation:	Based on the response factor (TIC peak area) of the external standard *n*-decane
Reporting Detection Limit:	0.1 ug/g (ppmw)

Note:
The outgassing condition is optimized for the analysis of volatiles and semi-volatiles with boiling points greater than 80^{o}C (R.T. > 3.5 min). Very volatile organic compounds such as acetone, benzene, and other light hydrocarbons (<C7) are not recovered. Analysis of light hydrocarbons requires different experimental conditions and is available upon request.

Results and Comments:
See Figures 1 and 2 and Tables 1 and 2 for the types and concentrations of the outgassed organic compounds found in control and samples.

The major compounds found were organic acid esters with a total outgassed impurity level of 14 ppmw.

Report Prepared by: _____
Mark Eitel
Lab Supervisor

Report Reviewed by: _____
Wendy Lei
Lead Analyst

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File       : C:\HPCHEM2\2\DATA\200402\0210A30C.D
Operator   : wLee
Acquired   : 11 Feb 04  17:15     using AcqMethod OUTGAS1
Instrument :   GC6890/MS
Sample Name: SST Blk2 tube
Misc Info  :  B29734 100C 30min
Vial Number: 26
```

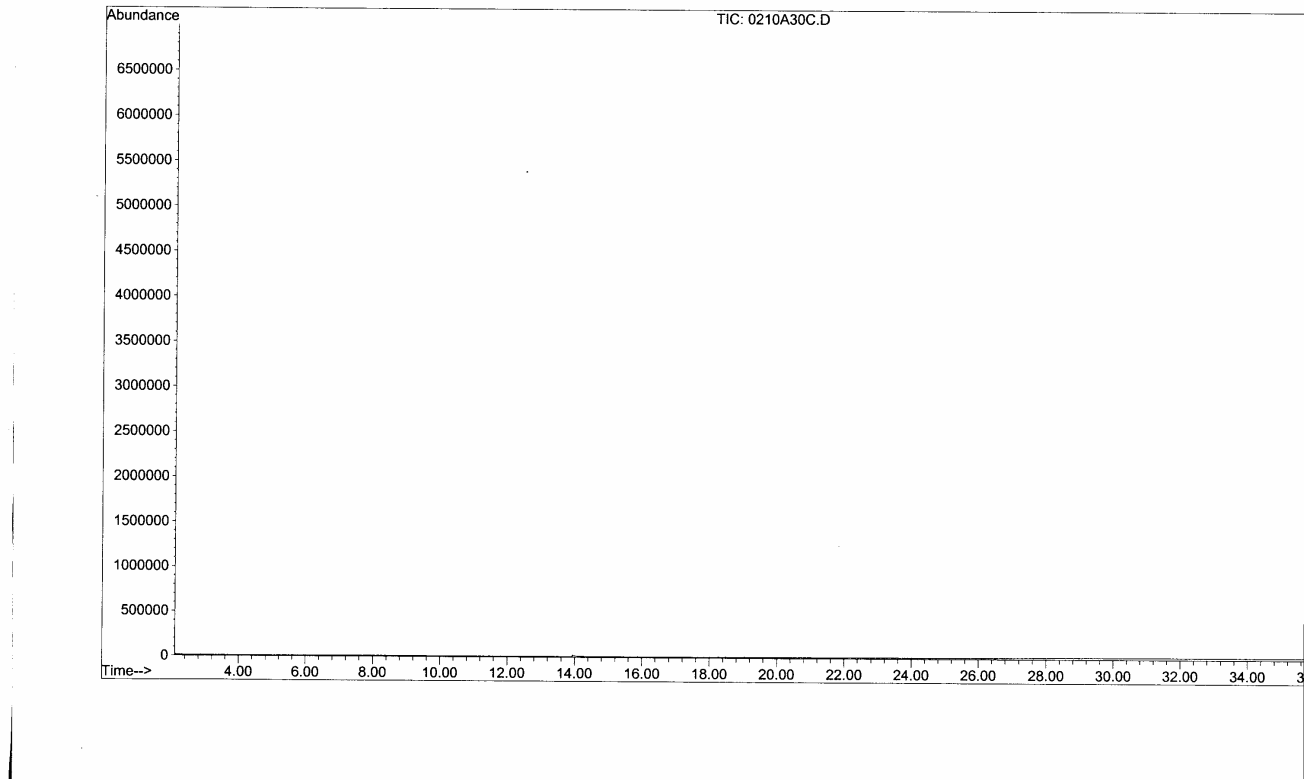

Figure 1. GC-MS Chromatogram of outgassing of a clean empty ATD tube as testing control (100°C for 30 min)

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```
File        : C:\HPCHEM2\2\DATA\200402\0210A27C.D
Operator    : wLee
Acquired    : 11 Feb 04  14:30      using AcqMethod OUTGAS1
Instrument :   GC6890/MS
Sample Name: 6422 Wafer carrier
Misc Info   : B27480 100C 30min 150.2mg
Vial Number: 23
```

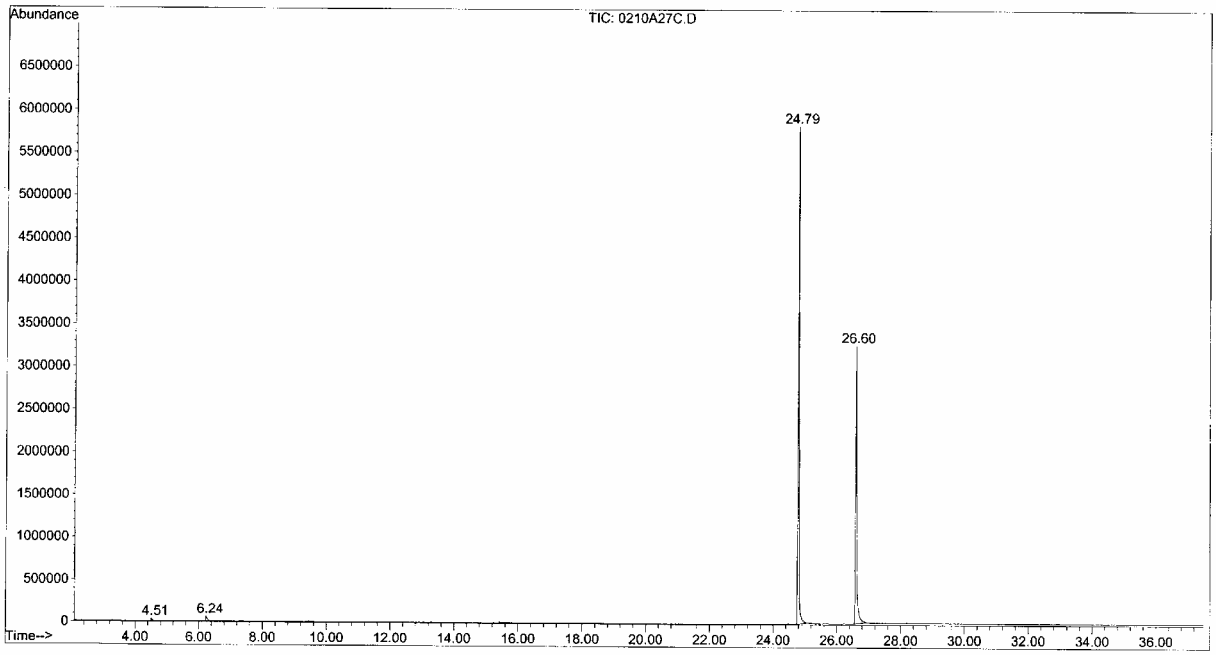

Figure 2. GC-MS chromatogram of outgassing of wafer carrier material (100°C for 30 min)

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Table 1. Results of Outgassing (50 °C for 30 min)

Sample ID	R.T. (min)[1]	Outgassing Compounds	Concentration ppmw (ug/g)[2]
Control Tube		No organic compounds were found in this control tube.	N/A
		Total Outgassing Compounds[3]	**<0.1**

Notes:

(1) R.T. = Retention Time, +/- 0.20 min.

(2) Semi-quantitation is based on the response factor of external standard *n*-decane, the detection limit was estimated to be 0.1 ug/g (ppmw).

(3) The amount of total outgassing compounds include all the peaks integrated in the chromatogram.

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Table 2. Results of Outgassing (100 °C for 30 min)

Sample ID	R.T. (min)[1]	Outgassing Compounds	Concentration ppmw (ug/g)[2]
Wafer Carrier Material	6.24	Benzene, chloro	0.14
	24.79	Hexadecanoic acid, butyl ester	8.2
	26.60	Organic acid ester	5.7
		Total Outgassing Compounds[3]	**14**

Notes:

(1) R.T. = Retention Time, +/- 0.20 min.

(2) Semi-quantitation is based on the response factor of external standard *n*-decane, the detection limit was estimated to be 0.1 ug/g (ppmw). All peaks above 0.1 ppmw are listed in the table.

(3) The amount of total outgassing compounds include all the peaks integrated in the chromatogram.