

## Outgas Analysis for Wafer Industries

### Investigation of Origin Compound Analysis in the Outgas Exhausted from the Carrier Box Material

The wafer was packed into the carrier box by the wafer manufacturing company, it was then shipped to the semiconductor company.

It well-known that the wafer was contaminated by outgas from the polymer materials which are composed the box during the transporting.

At the first, total outgas from a carrier box was analyzed by illustrated system in Fig. 12.

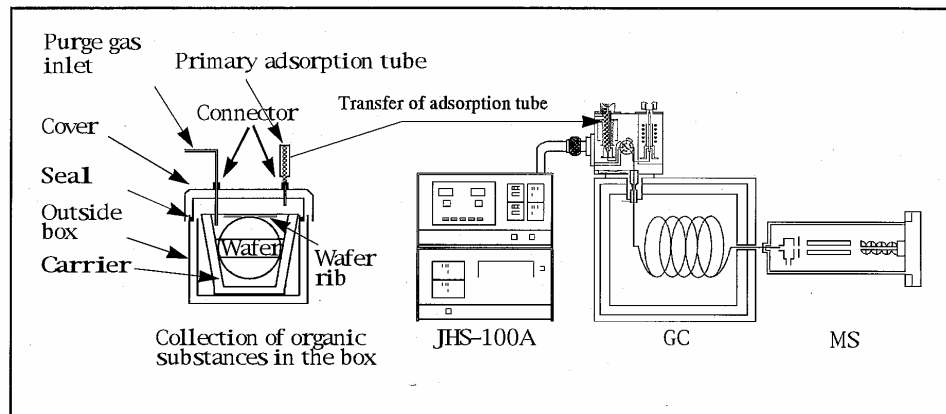


Fig. 12 Schcmatic diagram of the outgas analyzer system

**Carrier box :** 25 ea of 8" wafers are can be entered in the box.

**The materials of the box:** Outside box and carrier : Polypropylene; Cover : Polycarbonate; Wafer rib : Polybutylene terephthalate; Seal : EPDM

**Selling inlet and outlet line for the box:** Two connectors for inlet and outlet to be connected purge gas inlet and PAR are made by using oil free drill and M6 p=1 taps on the cover of the box.

**Sampling :** Purged by He 300 ml/min for 60 min at room temperature after pre-purging 20 min in order to reject original organic substances in the box.

Obtained VOC chromatogram from the carrier box by mentioned the above method is showed in the top of Fig. 13. Before 5 min of RT compounds are detected as environmental compounds in measured laboratory, because the prepurging 20 min was not enough time. After 5 min of RT, a lot of paraffin and olefin peak are observed. Especially, ethylbenzaldehyde (8),BHT decomposed compound (10), BHT (11 ) and DOP (12) are observed as polymer additives. (Total outgas amount on chromatogram for after RT 5 min of the carrier box was 240 ng.)

In order to investigate the origin of those polymer additives, 3 g of the cut seal was set into the sample tube of JHS-100A, it was then analyzed by P&T-GC/MS after heating the sample 80 for 30 min purging, the chromatogram is shown in the middle of Fig. 13. Peak No. 6, 7, 9 and 11 are quite same for the both chromatogram the top and the middle.

Also, 100 mg of cut carrier (inside carrier) was analyzed by the same method as the seal. Chromatogram of the outgas from the carrier is shown in the bottom of Fig. 13. The peak No. 8 and 11 are observed on the both chromatogram the top and the bottom.

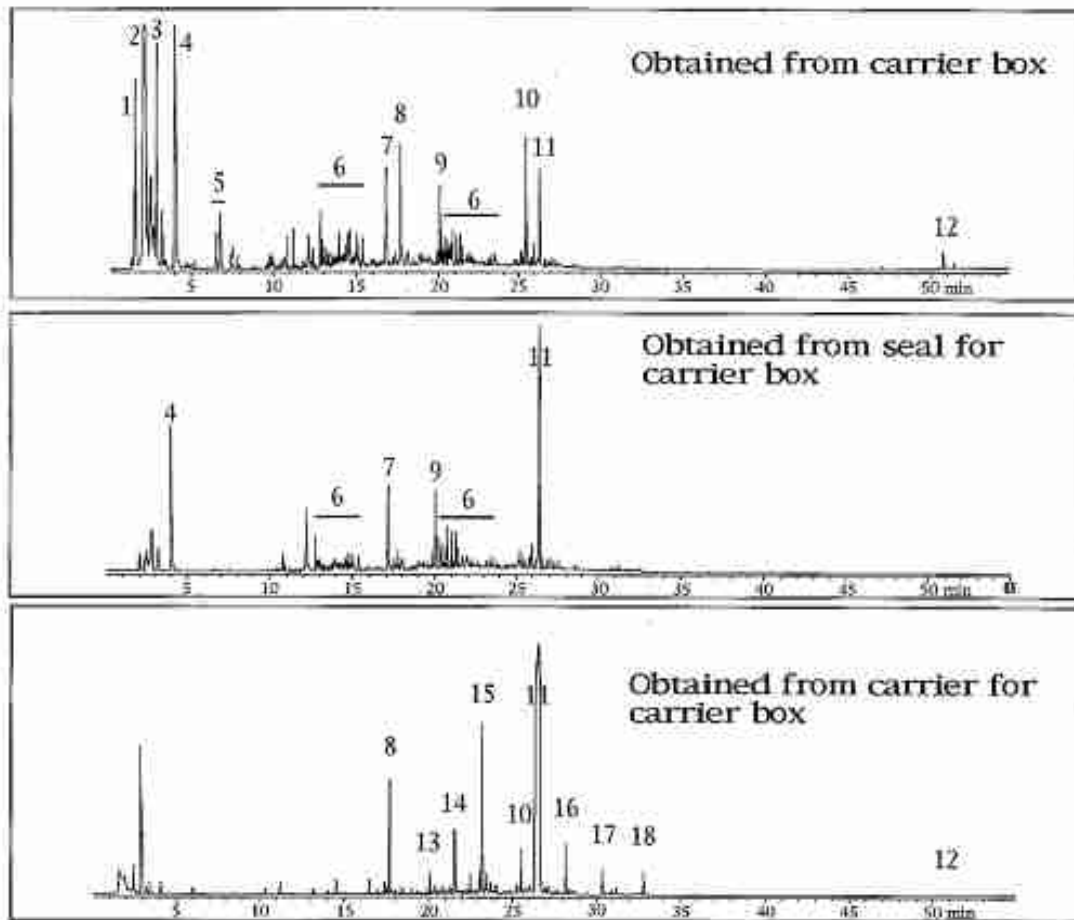


Fig. 13 VOC chromatograms from the carrier box, the seal and the carrier

1 : Acetonitrile ; 2 : Chloroform ; 3 : Heptane ; 4 : Toluene ; 5 : Xylcne ; 6 : Paraffin and olefin ; 7 : n-C<sub>12</sub> ;  
 8 : Ethylbenzaldehyde ; 9 : n-C<sub>15</sub> ; 10 : 2,6-di-t-butyl-4-methyl-ene-2,5-cyclohexadiene-1-one (decomposed  
 compounds from BHT) ; 11 : BHT ; 12 : DOP ; 13 : n-C<sub>13</sub> ; 14 : Dimethylsilicone (n=6) ; 15 : n-C<sub>16</sub> ;  
 16 : Butyl hexanoate ; 17 : Silicone compounds ; 18 : Butyl laurate

bottom of Fig.13. The peak NO.8 and 11 are observed on the both chromatogram the top and bottom.

### Results

Origin of peak No. 1 and 2 : from circumstances in the laboratory

Origin of peak No. 4 and 5 : from VOC in normal air

Origin of peak No. 6, 7, 9 and 11 : from the seal

Origin of Peak No. 8, 10 and 12 : from carrier

### Analytical Condition :

Instrument : GC/MS : HP5973, EI, 70 eV; Outgas collector : hand made; P&T : JHS-100A

Purging : The carrier box=300ml/min for 60 min, The polymer=each 3g 30ml/min for 30min at 80 °C, He ; Thermal  
 extraction :235 °C for 20 min ; PAT : Tenax GR;

Oven temp. of JHS-100A : 200 °C ; Secondary adsorption tube : Quartz wool;

Column : DB-2, 0.25 mm i.d. x 30 m, 40 μm (hold 3 min)-280 °C, 10 ml/min