

## Test Report

No. : CE/2017/22951

Date : 2017/02/18

Page : 1 of 13

POWERCHIP TECHNOLOGY CORPORATION  
NO. 12, LI-HSIN RD. 1, HSINCHU SCIENCE PARK, HSINCHU, TAIWAN, R. O. C.



The following samples was/were submitted and identified by/on behalf of the applicant as :

Sample Submitted By : POWERCHIP TECHNOLOGY CORPORATION  
Sample Description : POWERCHIP DRAM PROCESS WAFER  
Sample Receiving Date : 2017/02/13  
Testing Period : 2017/02/13 TO 2017/02/18

=====  
**Test Requested** :

- (1) As specified by client, with reference to RoHS 2011/65/EU Annex II and amending Directive (EU) 2015/863 to determine Cadmium, Lead, Mercury, Cr(VI), PBBs, PBDEs, DBP, BBP, DEHP, DIBP contents in the submitted sample.
- (2) Please refer to next pages for the other item(s).

**Test Result(s)** : Please refer to next page(s).

  
Troy Chang, Manager - Tech  
Signed for and on behalf of  
SGS TAIWAN LTD.  
Chemical Laboratory - Taipei



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# Test Report

No. : CE/2017/22951

Date : 2017/02/18

Page : 2 of 13

POWERCHIP TECHNOLOGY CORPORATION  
NO. 12, LI-HSIN RD. 1, HSINCHU SCIENCE PARK, HSINCHU, TAIWAN, R. O. C.



## Test Result(s)

PART NAME No.1 : WAFER

| Test Item(s)               | Unit  | Method   | MDL  | Result |
|----------------------------|-------|--|------|--------|
|                            |       |  |      | No.1   |
| Cadmium (Cd)               | mg/kg | With reference to IEC 62321-5 (2013) and performed by ICP-AES. | 2    | n.d.   |
| Lead (Pb)                  | mg/kg | With reference to IEC 62321-5 (2013) and performed by ICP-AES. | 2    | n.d.   |
| Mercury (Hg)               | mg/kg | With reference to IEC 62321-4 (2013) and performed by ICP-AES. | 2    | n.d.   |
| Hexavalent Chromium Cr(VI) | mg/kg | With reference to IEC 62321 (2008) and performed by UV-VIS.    | 2    | n.d.   |
| <b>Sum of PBBs</b>         | mg/kg | With reference to IEC 62321-6 (2015) and performed by GC/MS.   | -    | n.d.   |
| Monobromobiphenyl          | mg/kg |  | 5    | n.d.   |
| Dibromobiphenyl            | mg/kg |  | 5    | n.d.   |
| Tribromobiphenyl           | mg/kg |  | 5    | n.d.   |
| Tetrabromobiphenyl         | mg/kg |  | 5    | n.d.   |
| Pentabromobiphenyl         | mg/kg |  | 5    | n.d.   |
| Hexabromobiphenyl          | mg/kg |  | 5    | n.d.   |
| Heptabromobiphenyl         | mg/kg |  | 5    | n.d.   |
| Octabromobiphenyl          | mg/kg |  | 5    | n.d.   |
| Nonabromobiphenyl          | mg/kg |  | 5    | n.d.   |
| Decabromobiphenyl          | mg/kg |  | 5    | n.d.   |
| <b>Sum of PBDEs</b>        | mg/kg |  | -    | n.d.   |
| Monobromodiphenyl ether    | mg/kg |  | 5    | n.d.   |
| Dibromodiphenyl ether      | mg/kg |  | 5    | n.d.   |
| Tribromodiphenyl ether     | mg/kg |  | 5    | n.d.   |
| Tetrabromodiphenyl ether   | mg/kg |  | 5    | n.d.   |
| Pentabromodiphenyl ether   | mg/kg |  | 5    | n.d.   |
| Hexabromodiphenyl ether    | mg/kg |  | 5    | n.d.   |
| Heptabromodiphenyl ether   | mg/kg |  | 5    | n.d.   |
| Octabromodiphenyl ether    | mg/kg |  | 5    | n.d.   |
| Nonabromodiphenyl ether    | mg/kg | 5  | n.d. |        |
| Decabromodiphenyl ether    | mg/kg | 5  | n.d. |        |

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No. : CE/2017/22951

Date : 2017/02/18

Page : 3 of 13

POWERCHIP TECHNOLOGY CORPORATION

NO. 12, LI-HSIN RD. 1, HSINCHU SCIENCE PARK, HSINCHU, TAIWAN, R. O. C.



| Test Item(s)  | Unit  | Method   | MDL | Result   |
|---|-------|--|-----|----------|
|   |       |  |     | No.1     |
| BBP (Butyl Benzyl phthalate)<br>(CAS No.: 85-68-7)                | mg/kg | With reference to IEC 62321-8/CD (2013).<br>Analysis was performed by GC/MS. | 50  | n.d.     |
| DBP (Dibutyl phthalate) (CAS<br>No.: 84-74-2)                     | mg/kg |  | 50  | n.d.     |
| DEHP (Di- (2-ethylhexyl)<br>phthalate) (CAS No.: 117-81-7)        | mg/kg |  | 50  | n.d.     |
| DIBP (Di-isobutyl phthalate) (CAS<br>No.: 84-69-5)                | mg/kg |  | 50  | n.d.     |
| DIDP (Di-isodecyl phthalate) (CAS<br>No.: 26761-40-0; 68515-49-1) | mg/kg |  | 50  | n.d.     |
| DINP (Di-isononyl phthalate) (CAS<br>No.: 28553-12-0; 68515-48-0) | mg/kg |  | 50  | n.d.     |
| DNOP (Di-n-octyl phthalate)<br>(CAS No.: 117-84-0)                | mg/kg |  | 50  | n.d.     |
| Halogen-Fluorine (F) (CAS No.:<br>14762-94-8)                     | mg/kg | With reference to BS EN 14582 (2007).<br>Analysis was performed by IC.       | 50  | n.d.     |
| Halogen-Chlorine (Cl) (CAS No.:<br>22537-15-1)                    | mg/kg | With reference to BS EN 14582 (2007).<br>Analysis was performed by IC.       | 50  | n.d.     |
| Halogen-Bromine (Br) (CAS No.:<br>10097-32-2)                     | mg/kg | With reference to BS EN 14582 (2007).<br>Analysis was performed by IC.       | 50  | n.d.     |
| Perfluorooctane sulfonates<br>(PFOS-Acid, Metal Salt, Amide)      | mg/kg | With reference to US EPA 3550C (2007).<br>Analysis was performed by LC/MS.   | 10  | n.d.     |
| PFOA (CAS No.: 335-67-1)  | mg/kg | With reference to US EPA 3550C (2007).<br>Analysis was performed by LC/MS.   | 10  | n.d.     |
| Arsenic (As)  | mg/kg | With reference to US EPA 3052 (1996).<br>Analysis was performed by ICP-AES.  | 2   | n.d.     |
| Beryllium (Be)  | mg/kg | With reference to US EPA 3052 (1996).<br>Analysis was performed by ICP-AES.  | 2   | n.d.     |
| Red phosphorus  | **    | Analysis was performed by Pyrolyzer-<br>GC/MS.                               | -   | Negative |
| Antimony (Sb)   | mg/kg | With reference to US EPA 3052 (1996).<br>Analysis was performed by ICP-AES.  | 2   | n.d.     |

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# Test Report

No. : CE/2017/22951

Date : 2017/02/18

Page : 4 of 13

POWERCHIP TECHNOLOGY CORPORATION

NO. 12, LI-HSIN RD. 1, HSINCHU SCIENCE PARK, HSINCHU, TAIWAN, R. O. C.



| Test Item(s)   | Unit  | Method   | MDL | Result |
|--|-------|--|-----|--------|
|  |       |  |     | No.1   |
| Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified ( $\alpha$ -HBCDD, $\beta$ -HBCDD, $\gamma$ -HBCDD) (CAS No.: 25637-99-4 and 3194-55-6 (134237-51-7, 134237-50-6, 134237-52-8)) | mg/kg | With reference to IEC 62321 (2008). Analysis was performed by GC/MS. | 5   | n.d.   |

**Note :**

1. mg/kg = ppm ; 0.1wt% = 1000ppm
2. MDL = Method Detection Limit
3. n.d. = Not Detected = less than MDL
4. " - " = Not Regulated
5. \*\* = Qualitative analysis (No Unit)
6. Negative = Undetectable / Positive = Detectable

**PFOS Reference Information : POPs - (EU) 757/2010**

Outlawing PFOS as substances or preparations in concentrations above 0.001% (10ppm), in semi-finished products or articles or parts at a level above 0.1%(1000ppm), in textiles or other coated materials above 1 $\mu$ g/m<sup>2</sup>.

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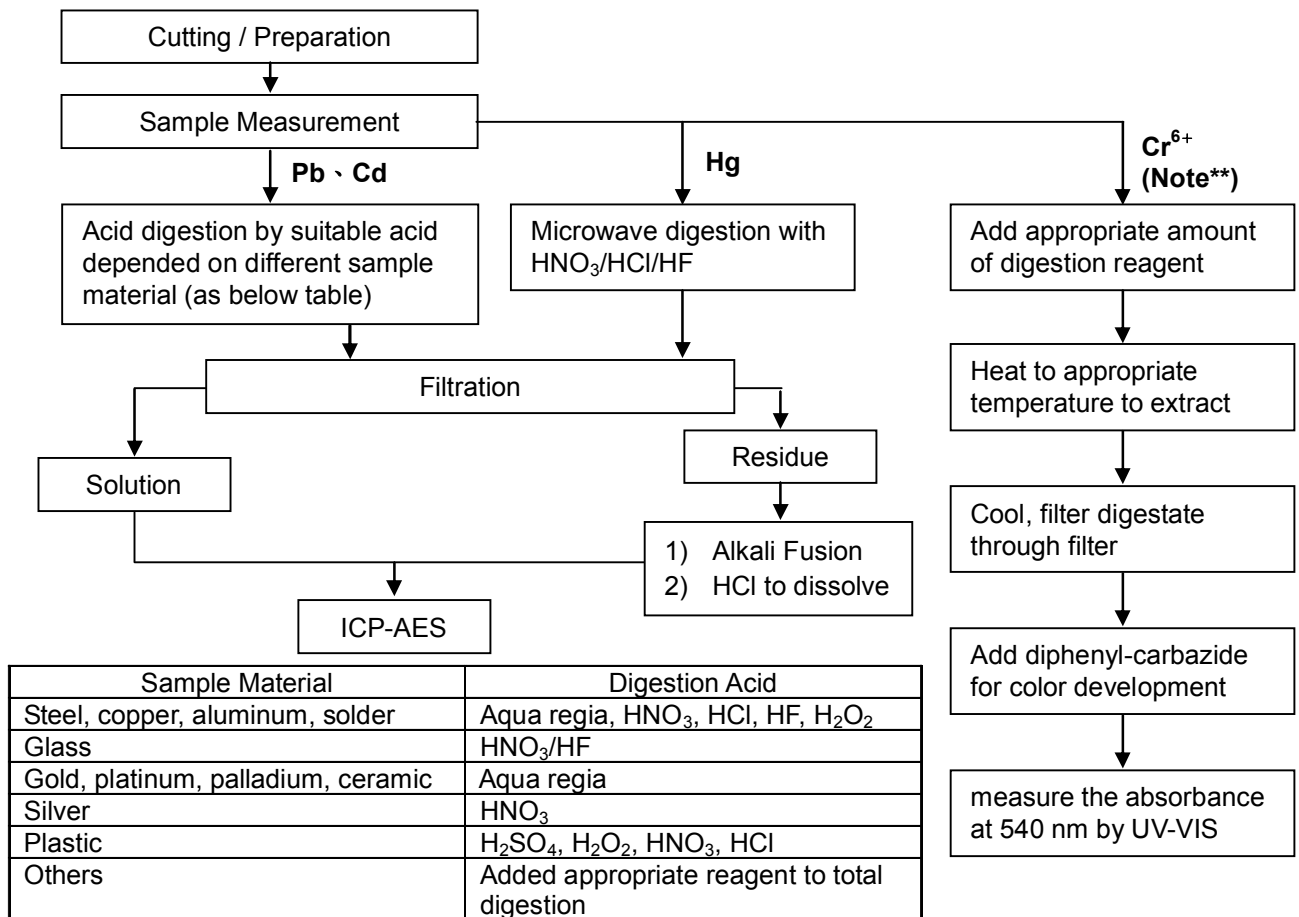


### Analytical flow chart of Heavy Metal

These samples were dissolved totally by pre-conditioning method according to below flow chart.

(Cr<sup>6+</sup> test method excluded)

- Technician: JR Wang
- Supervisor: Troy Chang



#### Note\*\* (For IEC 62321)

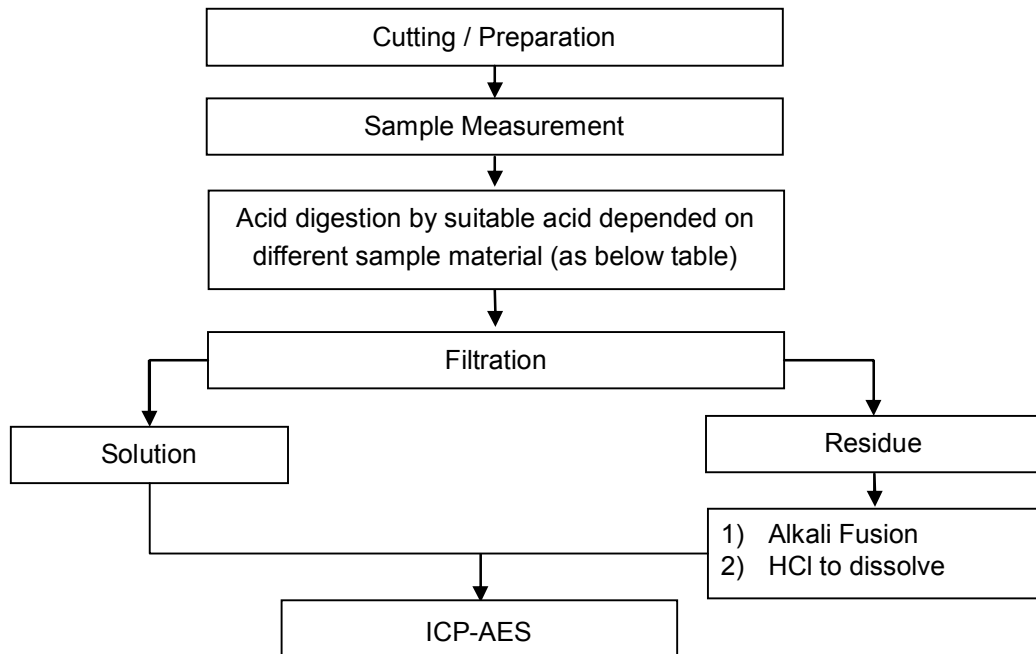
- (1) For non-metallic material, add alkaline digestion reagent and heat to 90~95 °C.
- (2) For metallic material, add pure water and heat to boiling.



These samples were dissolved totally by pre-conditioning method according to below flow chart.

- Technician: JR Wang
- Supervisor: Troy Chang

### Flow Chart of digestion for the elements analysis performed by ICP-AES

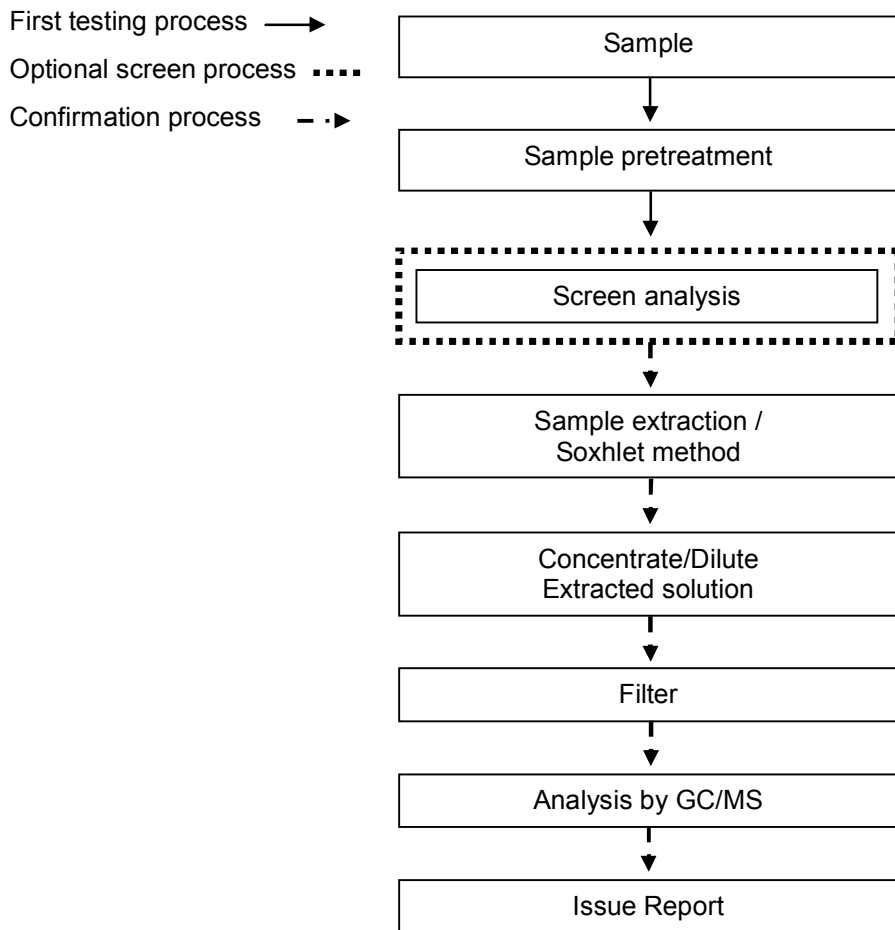


|                                    |   |
|------------------------------------|---|
| Steel, copper, aluminum, solder    | Aqua regia, HNO <sub>3</sub> , HCl, HF, H <sub>2</sub> O <sub>2</sub>                   |
| Glass                              | HNO <sub>3</sub> /HF  |
| Gold, platinum, palladium, ceramic | Aqua regia  |
| Silver                             | HNO <sub>3</sub>  |
| Plastic                            | H <sub>2</sub> SO <sub>4</sub> , H <sub>2</sub> O <sub>2</sub> , HNO <sub>3</sub> , HCl |
| Others                             | Added appropriate reagent to total digestion  |



### Analytical flow chart – PBB / PBDE

- Technician : Yaling Tu
- Supervisor: Troy Chang



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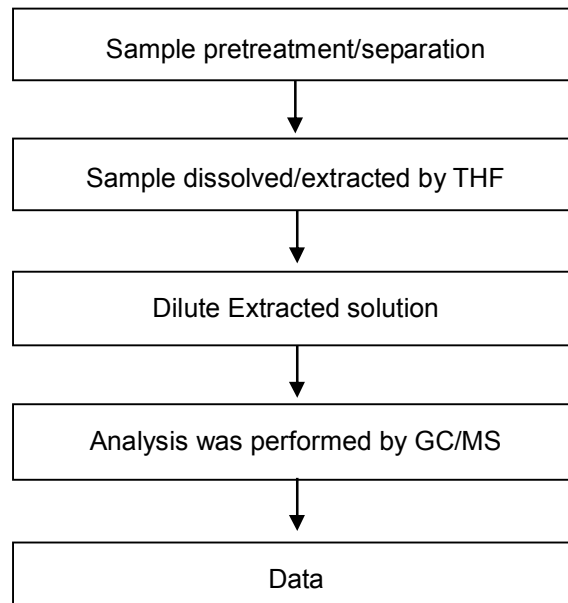
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### Analytical flow chart - Phthalate

- Technician: Andy Shu
- Supervisor: Troy Chang

#### **【Test method: IEC 62321-8】**



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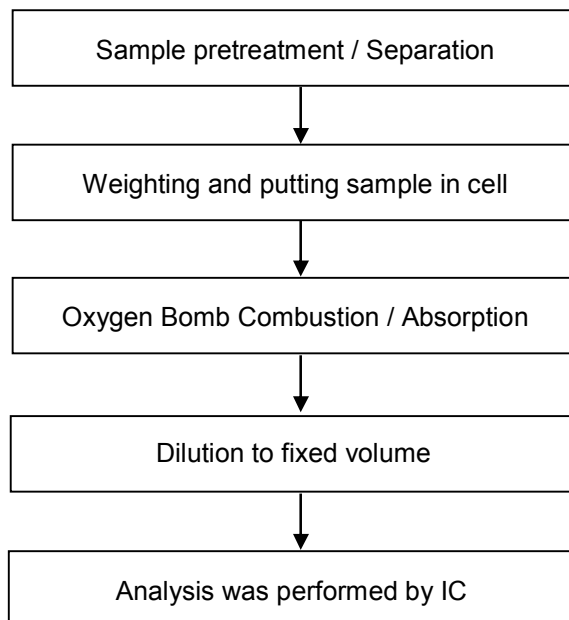
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### Analytical flow chart - Halogen

- Technician: Rita Chen
- Supervisor: Troy Chang



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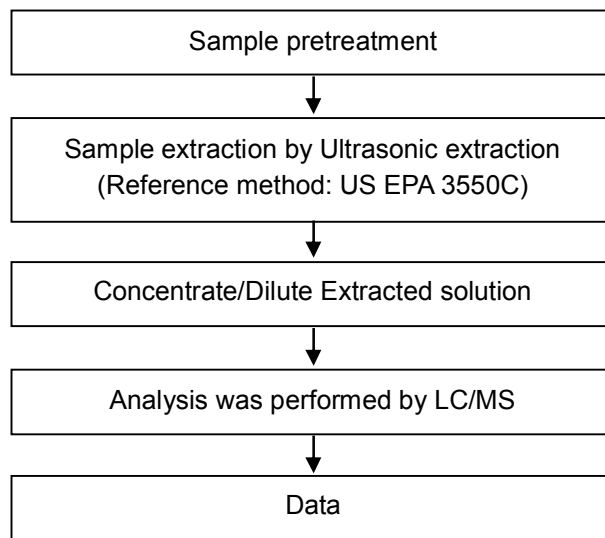
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### Analytical flow chart - PFOA/PFOS

- Technician: Yaling Tu
- Supervisor: Troy Chang



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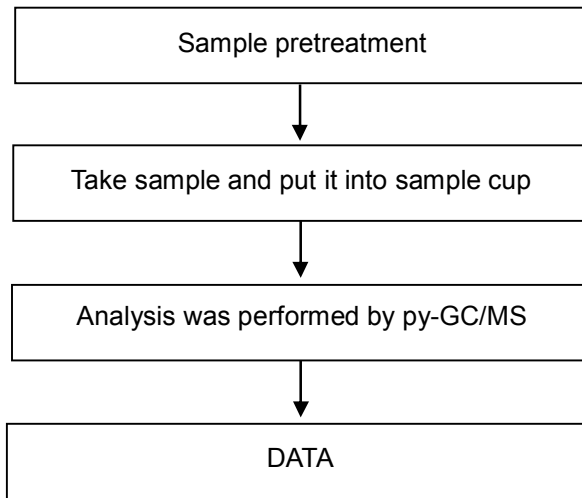
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### Analytical flow chart - Red phosphorus

- Technician: Yaling Tu
- Supervisor: Troy Chang



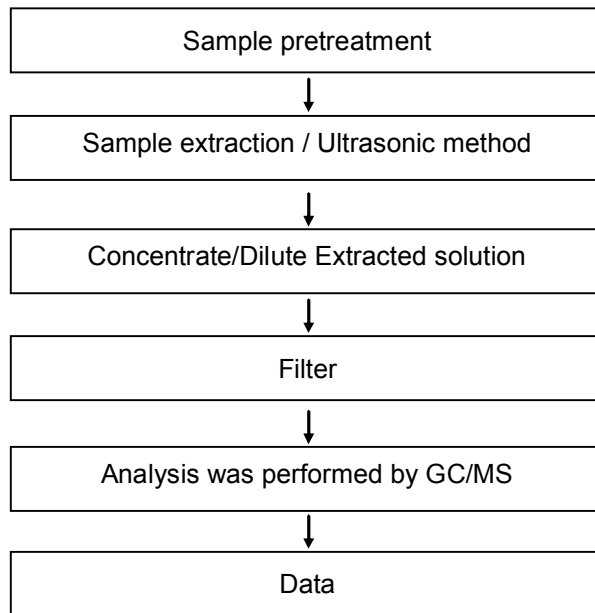
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### Analytical flow chart - HBCDD

- Technician: Yaling Tu
- Supervisor: Troy Chang



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No. : CE/2017/22951

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Page : 13 of 13

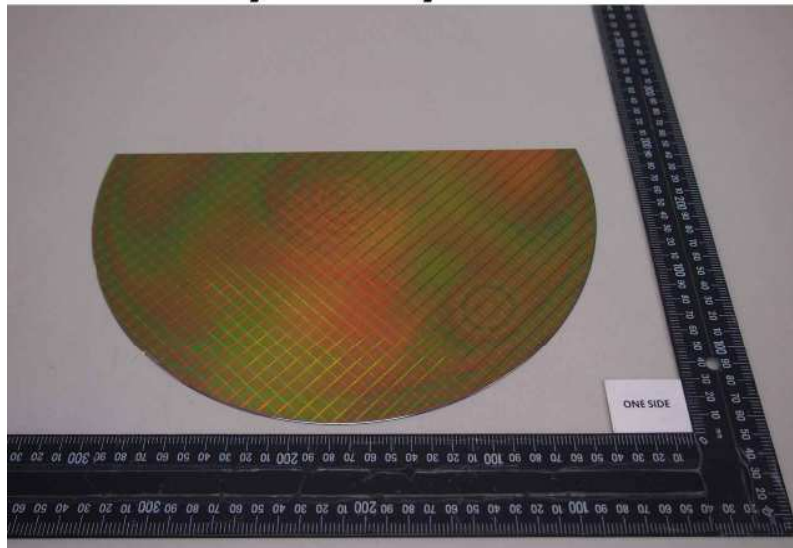
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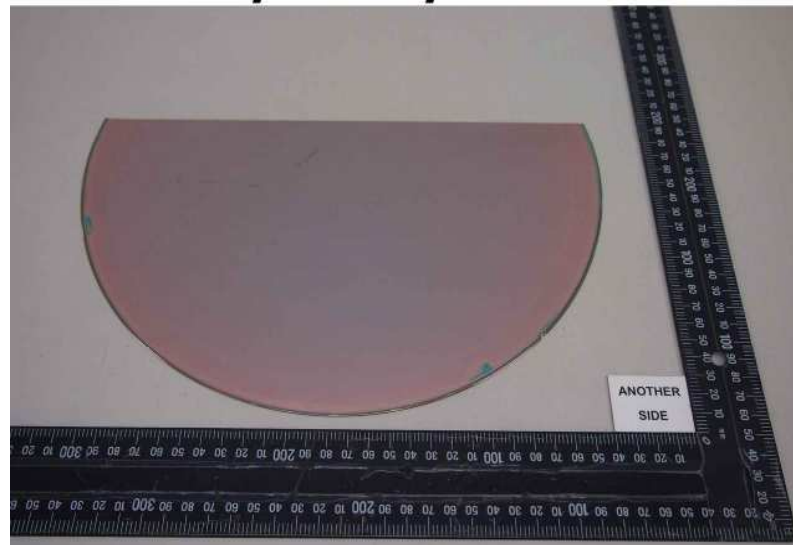


\* The tested sample / part is marked by an arrow if it's shown on the photo. \*

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\*\* End of Report \*\*

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