Decomposition of Perfluorinated Compounds using Plasmas in Bubbles with Circulation of Exhaust Gas

**Target Techniques**

<table>
<thead>
<tr>
<th>Targets</th>
<th>Techniques</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFOS</td>
<td>Plasma</td>
<td>Yes</td>
</tr>
<tr>
<td>Humic acid</td>
<td>Ozone</td>
<td>No</td>
</tr>
<tr>
<td>Dioxin-like</td>
<td>AOPs</td>
<td>No</td>
</tr>
<tr>
<td>PFCs²</td>
<td>Bond</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Dioxin-like</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Humic acid</td>
<td>-</td>
</tr>
</tbody>
</table>

**WATER TREATMENT WITH PLASMA**

- Have interfacial activity
- Used in semiconductor industry
- Act as a carcinogen

**PLASMA WITHIN BUBBLES**

- PFOS can be decomposed by a plasma

**Disadvantages**

- Very minor treatment capacity
- Emission of greenhouse gases

Many plasmas generation with gas circulation is required.

**Experimental technique**

- PFOS decomposition system with gas circulation

**Experimental results**

- Target: PFOS solution
  - Quantity: 1000 mL
  - Initial concentration: 50 mg/L
  - Gas bubble: Argon (100sccm)

- Inverter frequency: 20 kHz
- Average Power: 114 W
- Treating time: 600 min
- Total input energy: 1140 Wh

**Degradation of PFOS with 21-plasmas**

- 21-plasmas can decompose 91% of PFOS in 600 minute.
- The treatment capacity is up to 20 times larger than conventional DC plasma reactor.
- Fluorocarbon gases contained in the exhaust gas are exposed to the plasma and can be decomposed.
- Gas consumption of argon is considerably reduced using circulation of exhaust gas.

We have successfully decomposed the large amount of PFOS solution with 21-plasmas.

(H. Obo)