International Recycling Network of Mobile Phone in Asia Region

Metal Recovery from E-Waste, Poly-Metallic Material

October 31, 2006

Masayuki Naka

DOWA ECO-SYSTEM CO., LTD.
Constituents in E-Waste

- Cadmium
- Lead
- Antimony
- Arsenic
- Mercury
- Selenium
- Fluorocarbons (CFCs, HCFCs & HFCs)
- Brominated Flame Retardants

- Gold
- Silver
- Copper
- Platinum

........Etc.
## Metal Contents in Electronic Equipments

<table>
<thead>
<tr>
<th>Item</th>
<th>Au ppm</th>
<th>Ag ppm</th>
<th>Cu %</th>
<th>Pd ppm</th>
<th>Pb %</th>
<th>Bi %</th>
<th>Se %</th>
<th>Zn %</th>
<th>Cd %</th>
<th>Hg %</th>
<th>As %</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD Player</td>
<td>230</td>
<td>1,400</td>
<td>8.7</td>
<td>10</td>
<td>0.003</td>
<td>0.001</td>
<td>&lt;0.001</td>
<td>0.022</td>
<td>0.002</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>CD Player</td>
<td>130</td>
<td>1,210</td>
<td>5.5</td>
<td>6</td>
<td>0.180</td>
<td>0.002</td>
<td>0.001</td>
<td>0.003</td>
<td>0.002</td>
<td>0.010</td>
<td></td>
</tr>
<tr>
<td>Tape Recorder</td>
<td>40</td>
<td>850</td>
<td>8.2</td>
<td>6</td>
<td>0.140</td>
<td>0.004</td>
<td>0.004</td>
<td>0.008</td>
<td>&lt;0.001</td>
<td>0.006</td>
<td></td>
</tr>
<tr>
<td>Digital Camera</td>
<td>170</td>
<td>500</td>
<td>5.6</td>
<td>4</td>
<td>0.020</td>
<td>0.040</td>
<td>&lt;0.001</td>
<td>0.005</td>
<td>0.001</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Video Cam.</td>
<td>100</td>
<td>630</td>
<td>6.9</td>
<td>30</td>
<td>0.190</td>
<td>0.013</td>
<td>0.001</td>
<td>0.011</td>
<td>0.001</td>
<td>Tr.</td>
<td>0.014</td>
</tr>
<tr>
<td>Silicon Audio</td>
<td>500</td>
<td>2,400</td>
<td>11.3</td>
<td>50</td>
<td>0.400</td>
<td>0.003</td>
<td>0.001</td>
<td>0.011</td>
<td>0.002</td>
<td>0.023</td>
<td></td>
</tr>
<tr>
<td>Mobile Phone</td>
<td>400</td>
<td>2,300</td>
<td>17.2</td>
<td>100</td>
<td>0.37</td>
<td>0.02</td>
<td>&lt;0.01</td>
<td>1.4</td>
<td>&lt;0.01</td>
<td>0.003</td>
<td></td>
</tr>
</tbody>
</table>
Potentiality of Nonferrous Metal Industry

• Complex contents in raw materials
  – Various elements (valuable metals and impurities) in crude ore
• Handling toxic substances in safety
  – Valuable but toxic metals (ex. Pb, Cd)
  – Contents as impurities (ex. As)

Unique role in environmental management & recycling
“The Anchor of Recycling”, “The Joint of Recycling Loop”

Dowa’s Business Model: Integration between Metals Sector and Environmental Business Sector
DOWA’s Corporate Data

Founded: September 18, 1884
Incorporated: March 11, 1937
Net sales: JPY 316,388 million (as of FY2005)
Net income: JPY 14,532 million (as of FY2005)
Total assets: JPY 309,315 million (as of end of FY2005)

Main Businesses

- Nonferrous Metals
- Environmental Management and Recycling
- Electronic Materials
- Metal Processing
- Heat Treatment

![Pie Chart]

- Metal: 40%
- Elec: 33%
- Eco: 19%
- Heat: 11%
- Others: 3%
Overall Business Activities

DOWA ECO-SYSTEM CO., LTD.
Environmental Management & Recycling

DOWA METALS & MINING CO., LTD.
Nonferrous Metals
Gold, Silver, Copper, Zinc, Platinum group metals, Gallium, Indium, etc.

DOWA METALTECH CO., LTD.
Metal Processing
Connector Materials,

DOWA THERMOTECH CO., LTD
Heat treatment for automobile parts, Industrial furnace

DOWA ELECTRONICS MATERIALS CO., LTD.
Gallium LEDs, Silver Powder, Zinc Powder,

Included in final Products
Personal Computers
Plasma Televisions
Mobile Phones
Batteries,
Magnetic Recording Tapes, Automobiles, etc

Support of Sustainable Development through our Operations
E-waste Recycling

Crashed OA

Button shaped batteries

PCB

Mobile Phone
Process Flow of Dowa’s Smelter/Refineries Complex

E-Waste

Dismantling, Crushing, Incineration, etc.

Zn-Concentrate (Ore).

Roaster

Leaching Plant

Acid Plant

Roaster

Leaching Plant

Acid Plant

Zn Refining

Purification

Hematite Process

Hematite Process

Copper Smelter

Cu Refining

Lead Refinery

Acid Plant

Zn Refining

Cd Refining

Rare Metal Plant

H₂SO₄ Zn Cd Cu Concentrate (Ore)

Bi Sb Se Te Pt Pd Rh

H₂SO₄ Pb Bi Sb Sn Au Ag Se Te Pt Pd Rh

Ga In Ge

Cu Refining

Precious Metal Plant
## Difference between Hydro-Metallurgy and Dowa’s Technology

<table>
<thead>
<tr>
<th></th>
<th>Hydro-Metallurgy</th>
<th>Dowa’s Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key Process</strong></td>
<td>Cyanidation, Amalgamation or Acid Leaching</td>
<td>Integrated Smelter/Refineries</td>
</tr>
<tr>
<td><strong>Recoveries</strong></td>
<td>Precious Metals only</td>
<td>Base Metals, Precious Metals &amp; Rare Metals</td>
</tr>
</tbody>
</table>
Dowa’s Overseas Activities in Metal Recycling

- **China**: Dowa Environmental Management Co., Ltd.
  - Recovering Precious Metals from E-Wastes
- **USA**: Nippon PGM America Inc.
  - Pre-treatment & Shipping Centre for Catalysts of ELV
- **Singapore**: Eco-system Japan Co., Ltd. Singapore
  - Collecting and Shipping Centre for E-Wastes
Pilot Project to Establish Scheme for Collection and Movement of E-Waste from SE Asia to Japan

- **Stage1 (FY2006)**
  - Study on the pilot scheme with a fund of JPY10M contributed by DOWA

- **Stage2 (FY2007)**
  - Implementation of the pilot scheme utilizing outcome of stage1

- **Objective:**
  - To establish collecting scheme of end of life mobile phones generated in Malaysia, Singapore and Thailand through a collaboration of relevant authorities
  - To establish transboundary movement scheme of the mobile phones from those countries to Japan
  - To investigate the possible application of those schemes to e-wastes other than mobile phones
International Recycling Network of Mobile Phone in Asia Region

- Collection in Thailand, Malaysia, Singapore
- Transport
- Performing by DOWA
- Recycling in JAPAN

End of life Mobile phones

Dowa’s Smelter

Map of Asia highlighting countries and recycling process.