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></td>
<td>0.010</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></td>
<td>0.006</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></td>
<td>0.023</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></td>
<td>0.003</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
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.

Support of Sustainable Development through our Operations

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

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

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

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

Dismantle & Shredding

Catalyst

ASR

Incinerator

Crushing & Separation

Crushing & Separation

Smelting

PGM metals
Platinum
Palladium
Rhodium

Market

Dowa’s Activities

Automobile

Circuit Board

Refrigerator

Household Appliance

Washing Machine

Air conditioner

Mobile Phone

TV

PC

Gold

Silver

Copper
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
Purification

Acid Plant

Zn Refining
Cd Refining
Hematite Process

Rare Metal Plant

H₂SO₄ Zn Cd Ga In Ge

Pb Bi Sb Sn H₂SO₄ Cu Ni

Au Ag Se Te Pt Pd Rh

Copper Smelter
Fly Ash Collector
Cu Refining

Lead Refinery
Acid Plant

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