The Recycling of Base Metals in Japan
Initiatives and Incentives

May 8, 2019

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Position of Japanese Base Metals in the World Market

**Refined Cu Production (2018)**

- **23,767kt**
  - Chile, 2,461, 10%
  - Others, 7,881, 33%
  - DRC, 824, 3%
  - Russia, 949, 4%
  - USA, 1,107, 5%

**Refined Cu Consumption (2018)**

- **23,830kt**
  - South Korea, 621, 3%
  - Germany, 1,208, 5%
  - Others, 6,655, 28%
  - USA, 1,825, 8%

**Zn Production (2018)**

- **13,400kt**
  - USA, 880, 7%
  - South Korea, 716, 5%
  - India, 714, 5%
  - Others, 4,426, 32%

**Zn Consumption (2018)**

- **13,330kt**
  - USA, 880, 7%
  - South Korea, 716, 5%
  - India, 714, 5%
  - Others, 4,426, 32%

*Source: WBMS March 2019*
Position of Japanese Base Metals in the World Market

Pb Production (2018)
11,896kt

Pb Consumption (2018)
12,099KT

Source: WBMS March 2019

Dominant Position of China

Cu
Zn
Pb
Base Metals Production & Recycling Rate in Japan

Cu Production & Recycling Rate

Source: Japan Mining Industry Association

Trend of Cu and As grade in copper conc. for Japan

As 0.04➡0.09%
Cu 32➡26%
Increase of Arsenic Burden
As/Cu Ratio = 2.8
Decrease of Cu
Conc. Feed Requirement +25%
3.1dmt/t-Cu ➡3.9dmt/t-Cu
or
More Scrap

Source: MERI/J
Base Metals Production & Recycling Rate in Japan

Zn

Zn Production & Recycling Rate

Pb

Pb Production & Recycling Rate

Base Metals Production & Recycling Rate in Japan

Recycle volume in 2018 is estimated value
Source: Japan Mining Industry Association
Technology for Recycling of Base Metals - Au, Ag, Cu, Pb, Zn, Ni, Sn, Sb

Kosaka Smelter of DOWA: Direct Smelting into Ausmelt Furnace

Base Metals & Precious Metals Recycling Rate in Japan

Recycling Rate to Production

Pb
Ag
Au
Cu
Zn

Source: Japan Mining Industry Association

Pb Smelting
Cu Smelting

Various Recycled Materials

Cu, NiSO₄

Sn, Te

Bi, Se, Te

Pb, Sn

Pb, Sn
Technology for Recycling of Base Metals - Cu

Copper recovery process from Auto Shredded Residue at DOWA

General Flow of car recycling

2005: Enforcement of the Automobile Recycling Law in Japan
Scrapped Car in 2017: 3.3 million cars, Export as Used Car in 2017: 1.4 million cars
Cu content in Auto Shredded Residue: 1.5%
Materials Recycle & Thermal recycle to utilize ASR

Zn Recycling from Steel Dust in Japan

Steel Production 100 million t
Dust Generation 5,405kt

Contents of Steel Dust with high halogen

Zinc Content to be recovered: Total 65-225kt/y
BF/CF Dust: 5-125kt/y
EAF Dust: 60-100kt/y

Zn Production in 2018: 521kt
Zn from EAF Dust: 70kt
Zn from BF/CF Dust: 16kt
Recycling Rate to production: 16.5%
Technology for Recycling of Base Metals-Zn from EAF Dust

EAF Dust of Steel Mill : Zn 15-25% ⇒ Zn 60% <

Pre-treatment of EAF Dust at Shisaka Works of Sumitomo

Final treatment at Hachinohe ISP Plant of Mitsui

Technology for Recycling of Base Metals-Zn

BF/CF dust pre-treatment at Nippon Steel

Final treatment at Akita Zinc Recycling Plant + Akita Zinc Refinery of DOWA

BF/CF dust pre-treatment at Nippon Steel

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Final treatment at Akita Zinc Recycling Plant + Akita Zinc Refinery of DOWA
Technology for Recycling of Base Metals - Pb

1. Free Pick-up System operated by SBRA (Lead Acid Storage Battery Recycle Association)
   - Purpose: 1. Prevention of Illegal Dumping 2. Proper Processing 3. Recycling within Domestic, but no merit for Waste Discharge Person

2. “Sell & Buy” System by Trader/Merchant
   - Merit for Waste Discharge Person , but Illegal Dumping or Loosing Domestic Resource Circulation by Export to Inappropriate Processing Company

Crisis & Overcoming of Waste Lead-Acid Battery Recycling

- Waste Lead-Acid Battery Export from Japan to Korea ➔ Decrease Domestic Resource Circulation
- 2016: Environmental problems occurred in Korea ➔ Oct. 2018: Enforcement of Amended Domestic Basel Rule ➔ Drastic Reduction of Export to Korea
- 2019: Increase of Recycling Rate to be expected
Collaboration of Japanese Non-Ferrous Industry

Important Role of Non-Ferrous Smelters in Japan as Essential Industry for CE

Mobile Phone, Circuit Board, ASR, Auto Spent Catalyst, Cu Scrap, Ag₂O Battery, Pb Battery, EAF Dust, Steel Dust, PCB Oil, Slag/Metal from Public Direct Melting Furnace, Plastics, Waste Acid

Industries of Automobile
Home Appliance
Telecommunication
Wire Cable

Steel Industry
Copper Smelter
Zinc Smelter
Lead Smelter
Industrial Waste
Public Waste

Red Letter: Base Metal Smelter & Refinery
6 Copper Smelter
5 Zinc Smelter
5 Lead Smelter

Black Letter: Subsidiaries of Non-Ferrous Smelting Company

Small Island, but so many non-ferrous plants in Japan to support Sustainable Society
Recycled Materials to Recover Valuable Metals

**Throughput into Japanese non-ferrous smelters**

- E-Scrap: 4.5 times increase since 2001
- Copper Scrap: 2.5 times increase since 2001

**Throughput into Smelters increase to double since 2001 to promote resource circulation**

Source: Japan Mining Industry Association

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Industrial Waste for volume reduction & detoxification

**Throughput into non-ferrous industry**

Various Industrial Wastes have been treated in non-ferrous industry to reduce and detoxify to support the sustainable society

Source: Japan Mining Industry Association
Tokyo Olympic 2020---Medal from Urban Mine

<table>
<thead>
<tr>
<th>Urban Mine</th>
<th>Resources in Japan</th>
<th>Mineral Reserves</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Au</td>
<td>6.8kt</td>
<td>54kt</td>
<td>12.6%</td>
</tr>
<tr>
<td>Ag</td>
<td>60kt</td>
<td>560kt</td>
<td>10.7%</td>
</tr>
<tr>
<td>Cu</td>
<td>38mt</td>
<td>830mt</td>
<td>4.6%</td>
</tr>
<tr>
<td>Pb</td>
<td>5.6mt</td>
<td>83mt</td>
<td>6.7%</td>
</tr>
<tr>
<td>Zn</td>
<td>13mt</td>
<td>230mt</td>
<td>4.8%</td>
</tr>
<tr>
<td>Ni</td>
<td>1.7mt</td>
<td>89mt</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

Mobile Phone Grade
10,000 units = 1t
Au 280g/t
Ag 2,100g/t
Cu 13.7%

As Just Reference

Transition of System to Promote Recycling in Japan

- 1970 Waste Management and Public Cleaning Law
- 1992 Basel Act (Act on Export, import and other management of specific hazardous wastes, etc.)
- 1993 Basic Environmental law
- 2000 Fundamental Law for Establishing a Sound Material-Cycle Society
- 2000 Law for Promotion of Effective Utilization of Resources
- 2000 Act on the Promotion of Sorted Collection and Recycling of Containers Packing (Steel Cans, Aluminum Cans)
- 2001 Act on recycling Specified kinds of Home Appliances (Air Con, TV Refrigerator, Washing Machine)
- 2005 Act on Recycling of End-of-Life Vehicles
- 2013 Act on Promotion of Recycling of Small Waste Electrical and Electronic Equipment
  - Certified business operators do not require the permission of the municipal waste disposal business
- 2018 Amended Basel Act
  - For recycling purposes imported from under developing countries, the restriction of the waste electronic board is abolished, and the notification, consent, and import approval are unnecessary.
  - Setting strict verification criteria for environmental pollution prevention measures for export destinations (Example) export of lead-acid batteries
Conclusion

1. The non-ferrous industry plays an extremely important role in establishing a sustainable resource recycling society.

2. It contributes not only to the recovery of valuable metals but also to the volume reduction and detoxification of waste materials.

3. The collaboration of copper, lead and zinc smelters allows us to recover not only base metals, but also various metals such as precious metals and rare metals.

4. Copper grade in copper concentrate will continue to decrease in the future, and at the same time, impurities such as arsenic increase. Under these changes, strengthening the smelting furnace and/or increasing the ratio of secondary raw materials (recycled raw material) have become means of survival for the non-ferrous smelting industry. To what extent the recycling rates can be raised requires the technical improvement in smelting process, and as a result, international competitiveness will be strengthened.

5. Japanese non-ferrous smelters rely on oversea mines for a total of 6.5 million tons of concentrate, such as 5.3 million tons of copper conc., 1 million ton of zinc conc., and 0.2 million tons of lead conc. It has a structure dependent on TC/RC. Active resource circulation can reduce its impact and make it cost competitive.

6. Japanese non-ferrous smelting industry will continue to actively promote an important role in contributing to the establishment of a circular economy through the active resource recycling.
Thank you for your attention

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リサイクルを促進するための制度の推移

- **1970**: 廃棄物の処理及び清掃に関する法律
- **1992**: パーゼル法（特定有害廃棄物等の輸出、輸入及びその他の管理に関する法律）
- **1993**: 基本環境法
- **2000**: 循環型社会形成推進基本法
- **2000**: 資源の有効利用の促進に関する法律
- **2000**: 容器包装の選別・リサイクルの促進に関する法律（アルミ缶スチール缶）
- **2001**: 特定種類の家電製品のリサイクルに関する法律（エアコン、テレビ、冷蔵庫、洗濯機）
- **2005**: 自動車のリサイクルに関する法律
- **2013**: 小型家電リサイクル法
  - 認定事業者は、市町村等の廃棄物処理事業の許可を必要としない。
- **2018**: 改正パーゼル法
  - 輸入国でリサイクル目的の場合：廃棄物报废の制限を撤廃し、通知・同意・輸入承認を不要とする。
  - 輸出先の環境汚染防止対策に関する厳格な確認基準の設定（例）鉛蓄電池の輸出