



TOHOKU  
UNIVERSITY

# Construction of Metal Resources Circulation System

## Based on Non-ferrous Smelting Industry

### E.Shibata Lab.

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#### Achievement of Metal Resources Circulation System based on Non-ferrous Metal Smelting Industry

Various Metal Resources (Mineral resources、E-scrap etc.)  
Material pre-treatments, Major reefing technology, By-products refining,  
Toxic elements stabilization etc.

Interdisciplinary research that breaks through the traditional framework of Non-ferrous metal smelting disciplines

##### Physical separation

- Crushing
- Flotation
- Gravity concentration
- Magnetic separation
- Electrostatic separation
- Automatic sorting etc.

##### Pyro-metallurgy

- Roasting
- Smelting
- volatilization
- Flue gas/  
Dust treatment
- Molten salt electrolysis  
etc.

##### Hydro/ Electrolytic refining

- Leaching
- Precipitation
- Purification
- Solvent extraction  
(ion exchange resin)
- Electrolytic  
refining/deposition etc.

In the future, the use of various electrical and electronic devices such as mobile phones, PC and electric vehicles is expected to increase at an accelerating pace with growth of population in the world.

In order to achieve sustainable utilization of metal resources, it is necessary to recycle metals from various waste materials.

In E.Shibata Lab., our goals are developing non-ferrous metal smelting technologies which are essential of achieving resources circulation and sustainable society and establish the metal resources recycling system based on non-ferrous metal smelting industry.

## Establishment of Metal Resources Circulation

### Non-ferrous smelting and recycling of secondary resources



ヘルパー銅山（石炭エネルギーセンター）  
URL: [http://www.jcoal.or.jp/coal/shiryō/material/03\\_fuji.pdf](http://www.jcoal.or.jp/coal/shiryō/material/03_fuji.pdf)



①資源ダスト（資源リサイクルセンター）  
URL: [http://www.jrcorec.co.jp/recycle/2011/20110106\\_02.html](http://www.jrcorec.co.jp/recycle/2011/20110106_02.html)  
②資源ダスト（日本鉱産）  
URL: [http://www.nipponkousan.co.jp/prdct\\_03.html](http://www.nipponkousan.co.jp/prdct_03.html)  
③資源ダスト（マツリヤコロコロ）  
URL: <http://www.mercocompany.co.jp/ja/recycling/metallurgical.html>

### Overseas mines

- Mining
- Mineral processing
- Refining
- Import



Zhezkazgan copper-smelting plant (AZERNEWS)  
URL: <https://www.azernews.az/region/143104.html>

### Secondary resources

- Shredder dust
- Sludge
- Steelmaking dust

### Pre-treatment

### Scrap

- Physical separation

### Secondary resources

Wastes electrical and electronic devices

### Non-ferrous smelting plant

Efficient circulation of metal resources based on non-ferrous metals

### Smelting



銅の地金（住友商事）  
URL: <https://www.azernews.az/region/143104.html>

### Wastes • Recycling



電子・電機機器（Insure direct）  
URL: <https://insuredirect.co/electronic-equipment-insurance-eei>

### Abundant metal resources in Secondary resources



### Metal resources circulation system based on non-ferrous smelting

