The Recycling potential of metals from MSW incineration residues

Minning the Technosphere
Potentials and Challenges, Drivers and Barriers

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Our world is in global structural change

„The old rule of thumb, that 80% of world’s mining production is consumed by 20% of mankind in Europe, United States and Japan is not correct any more ….

…. A structural change has taken place and today 50% of world’s mining production is consumed by 50% of mankind in the Peoples Republic of China, India and other countries with larger populations all over the world.“


1. Introduction
Most important nations in raw material consumption in 2011

1. Introduction
The development of GDP in China

http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG

Deike, R.: Resource efficiency against a background of changing international markets for industrial metals, Kendrion Symposium 2015, Rottweil 19.03.2015

1. Introduction
Price changes of different metals from 2000-2015
(1.Q. 2000 = 100 %)

Nach Daten: LME

2. Metal price changes
The global production of REE and the price development of Cerium and Lanthanum


Deike, R.: Resource efficiency against a background of changing international markets for industrial metals, Kendrion Symposium 2015, Rottweil 19.03.2015

2. Metal price changes
Entropy development during production use and recycling


3. Is recycling always useful?
Content of elements in ores

3. Is recycling always useful?
Content of different metals in MSW-incineration bottom ash in relation to metals contents in natural ores

4. The recycling potential of metals from MSW bottom ash
What is needed for a successful internal and external recycling process


4. The recycling potential of metals from MSW bottom ash
Different kinds of scrap separated with conventional technologies today


4. The recycling potential of metals from MSW bottom ash
Recycling potential of metals from mineral fraction


4. The recycling potential of metals from MSW bottom ash
Three dimensional microscopic photograph of a typical iron oxide particle


5. What happens with iron and aluminium in MSW-incineration?
Reaction between iron oxide and mineral phases

5. What happens with iron and aluminium in MSW-incineration?
Reduction of trace elements in mineral phases with magnetic separation

5. What happens with iron and aluminium in MSW-incineration?
Behaviour of Aluminium at about 900° C under normal atmosphere filmed with a high speed camera

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Behaviour of Aluminium at about 900° C under normal atmosphere filmed with a high speed camera

5. What happens with iron and aluminium in MSW-incineration?
XPS-measurement of an aluminium oxide layer on the surface of an aluminium lid heated up to 900°C

5. What happens with iron and aluminium in MSW-incineration?
SEM and EDS-measurement of an aluminium oxide layer on the surface of an aluminium lid heated up to 900° C

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5. What happens with iron and aluminium in MSW-incineration?
Burning of a fish tin at high temperature

Holz auf rotglühender Oberfläche rund 850 °C; Gasphase im Flammenbereich rund 1.000 °C

Verbrannt: 18 g

ca. 1 g Gewichtsverlust vermutlich auf Grund der verbrannten Beschriftung

Quelle: R. Warnecke


5. What happens with iron and aluminium in MSW-incineration?
Metal content of a fine fraction of MSW bottom ash

5. What happens with iron and aluminium in MSW-incineration?
Three dimensional microscopic photographs of different fractions after a magnetic separation

5. What happens with iron and aluminium in MSW-incineration?
Summary

- Our world is in a global structural change and metals prices are very volatile and determined by Chinese demand.
- More recycling is necessary but must be profitable.
- In the fine fraction of MSW-bottom ash the
  - copper content is as high as in poor copper ores,
  - iron is totally oxidised,
  - aluminium is protected by a very thin layer of aluminium oxide
- The recovery of metals is only economical, if the remaining mineral phase has not to be landfilled.