

International VDI Workshop

RECOVERY OF METALS AND MINERALS FROM ASH

CHARACTERISTICS OF METALS IN THE FINE FRACTION OF BOTTOM ASH & HOW CAN METAL
RECYCLING BE PROFITABLE IN VOLATILE GLOBAL RAW MATERIALS MARKETS

Amsterdam, 21.05.2014

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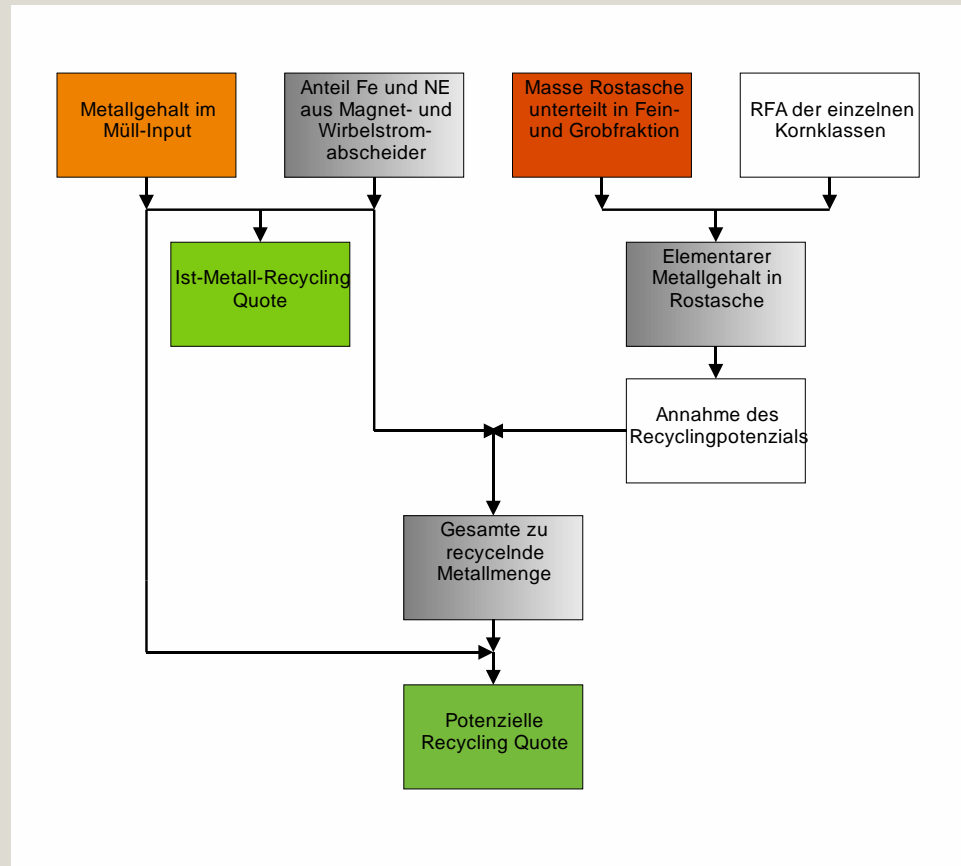
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³C.C. Reststoff-Aufbereitung GmbH, Würzburg

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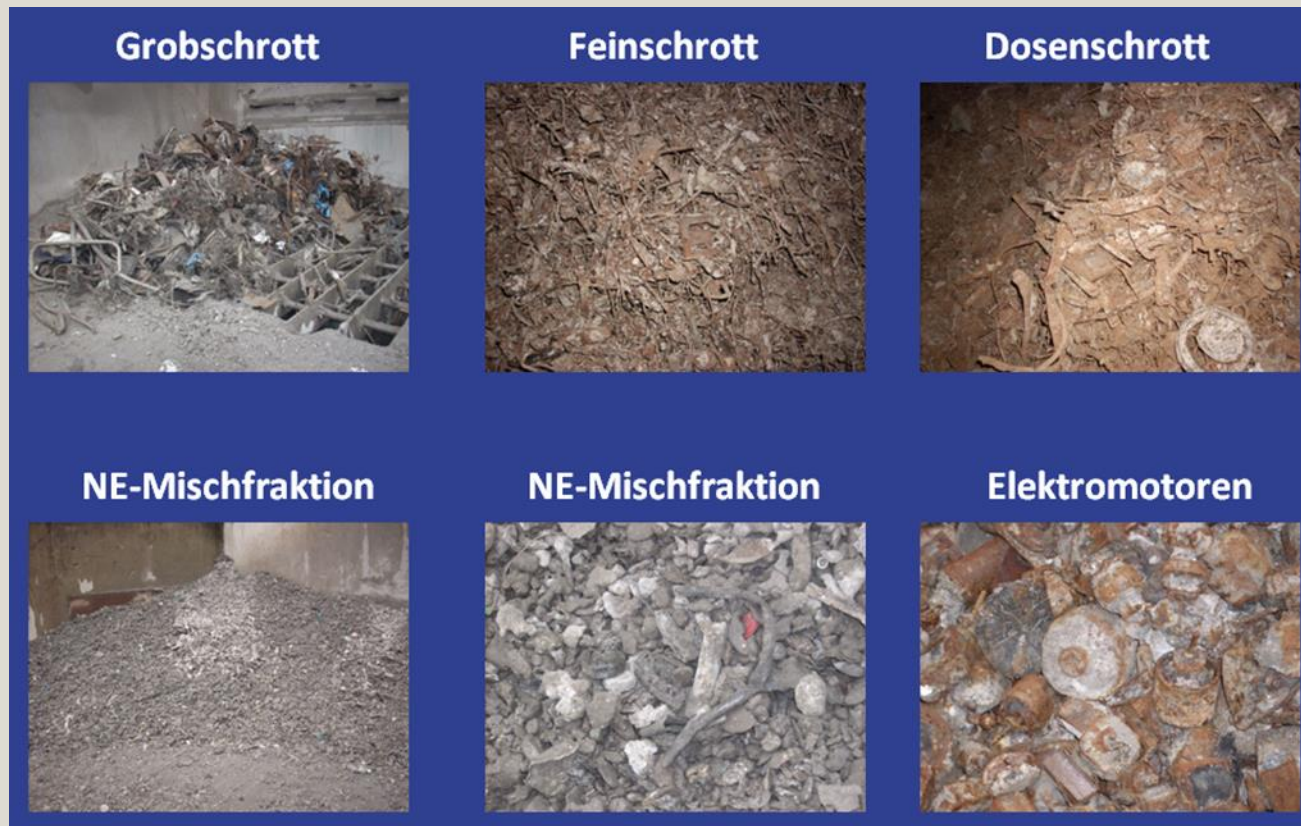
- 1. Recycling potential of metals from bottom ash**
- 2. Behaviour of metals at high temperature**
- 3. Distribution and relation of metals in different particle size fractions**
- 4. Changing raw material markets**

Procedure calculating possible recycling rates



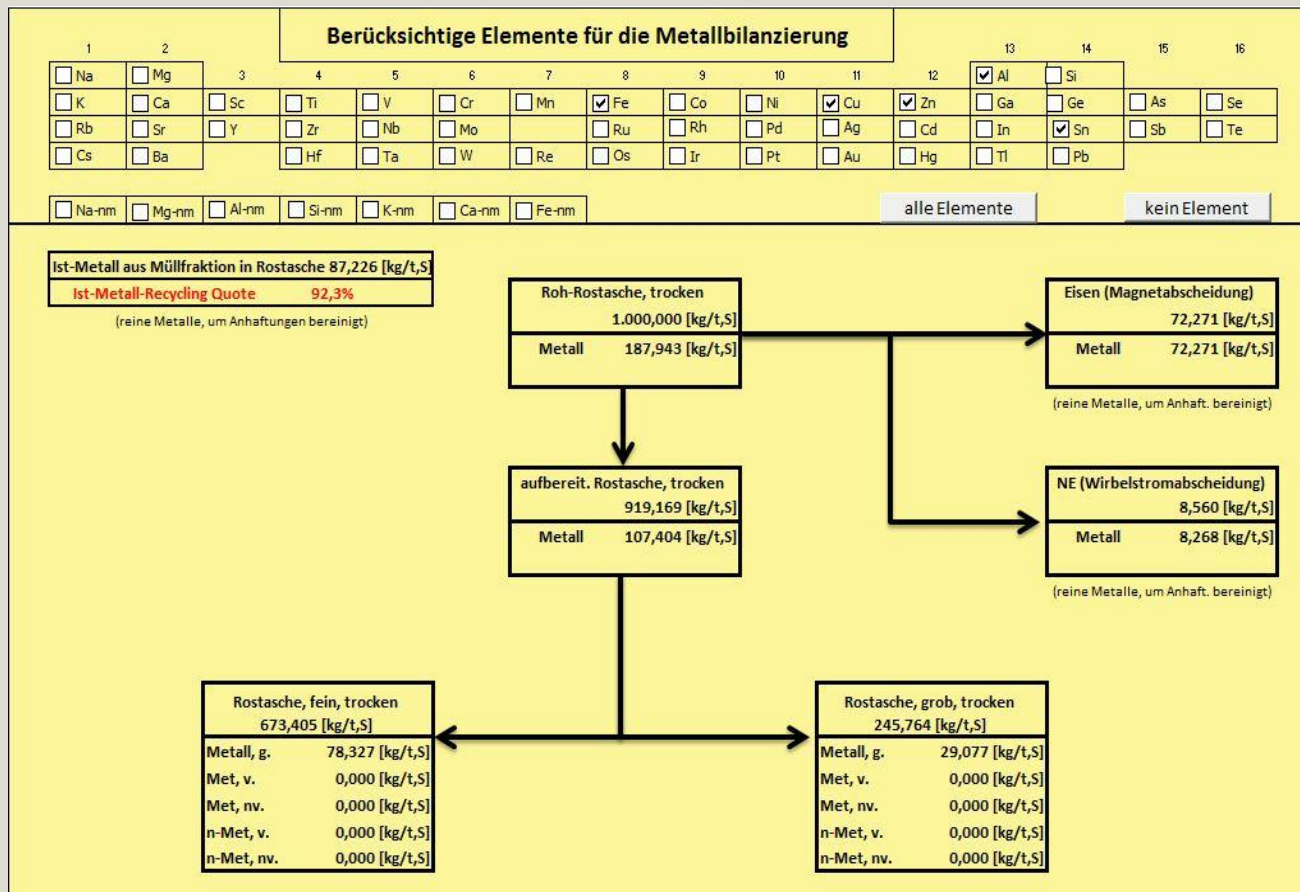
Warnecke, R.; Deike, R.; Ebert, D.; Vogell, M.: Jahrestreffen der ProcessNet-Fachgruppe Abfallbehandlung und Wertstoffrückgewinnung, DECHEMA, Frankfurt, 20.02.13

Different sorts of scrap separated with conventional technology today



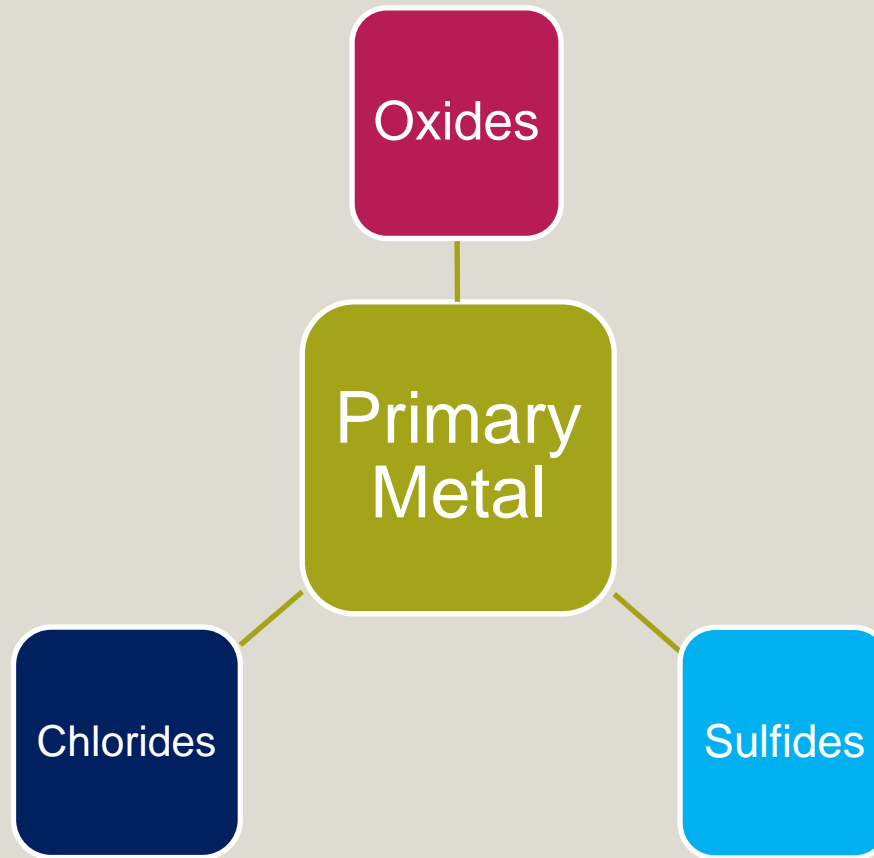
Warnecke, R.; Deike, R.; Ebert, D.; Vogell, M.: Jahrestreffen der ProcessNet-Fachgruppe Abfallbehandlung und Wertstoffrückgewinnung, DECHEMA, Frankfurt, 20.02.13

Recycling potential of metals from mineral fraction

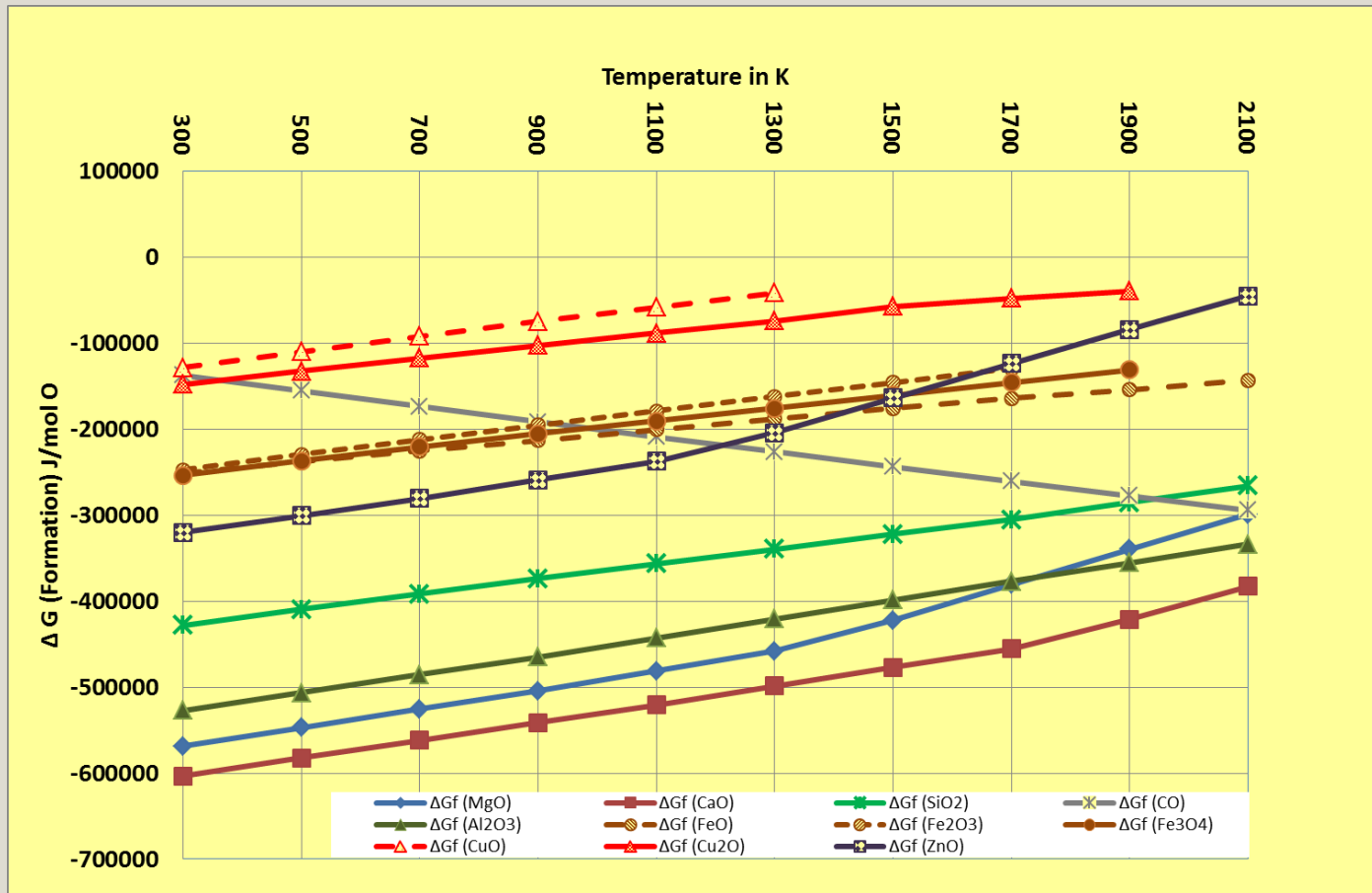


Deike, R.; Ebert, D.; Warnecke, R.; Vogell, M.: 24. VDI Fachkonferenz, Thermische Abfallbehandlung, Würzburg, 11.-12.10. 2012

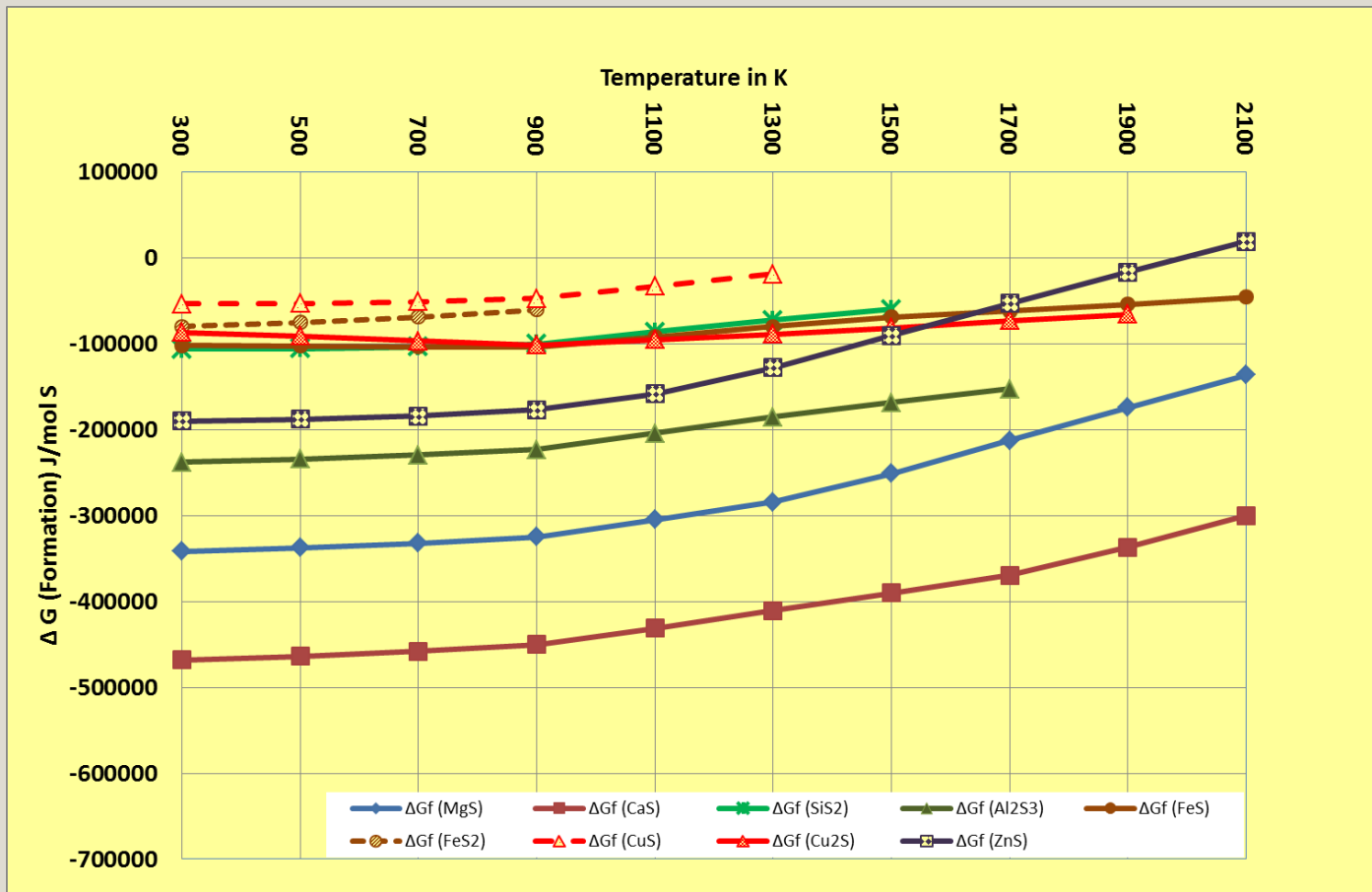
Behaviour of metals at high temperature



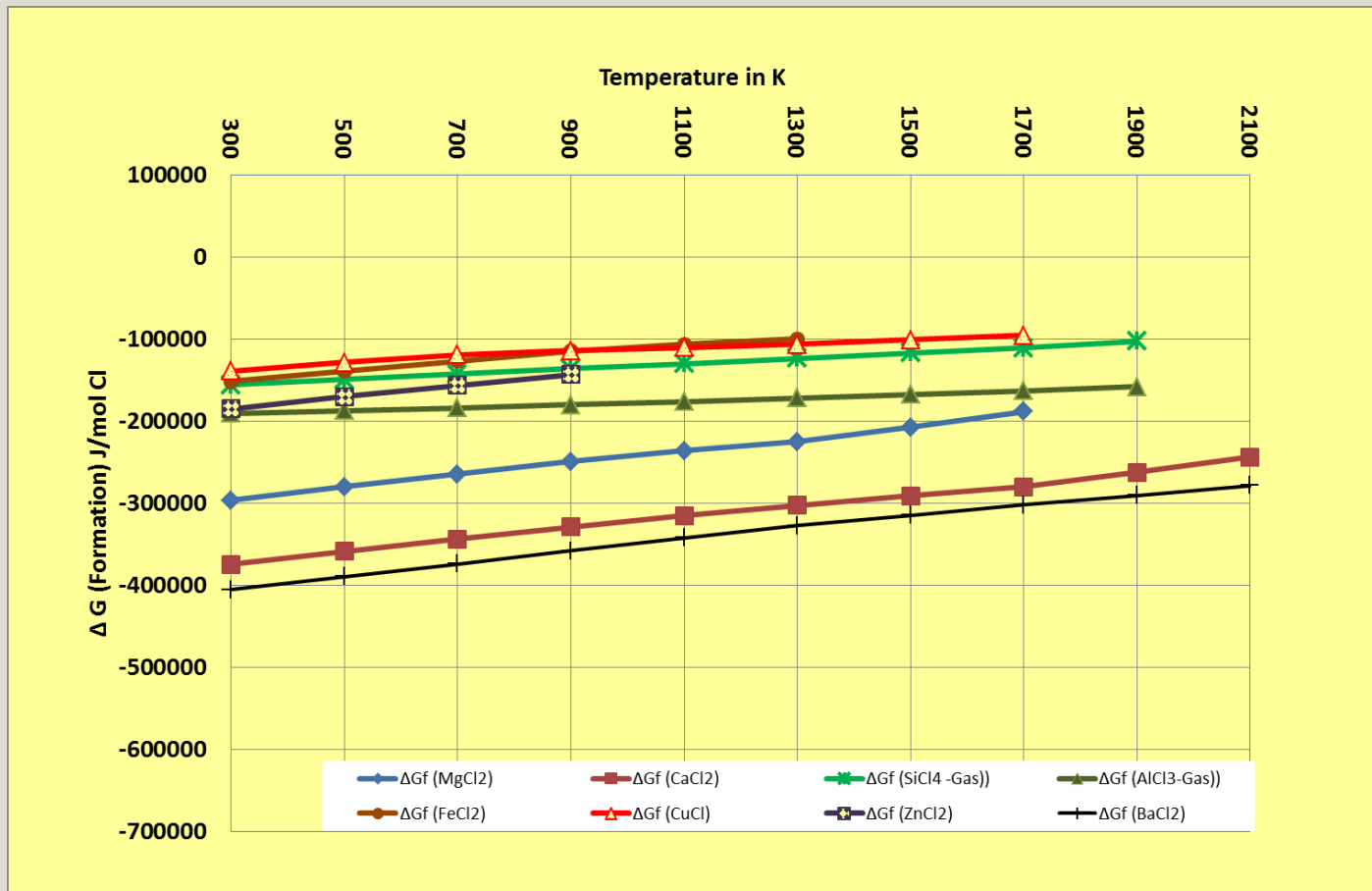
Gibbs Energies of different oxide reaction per mol O



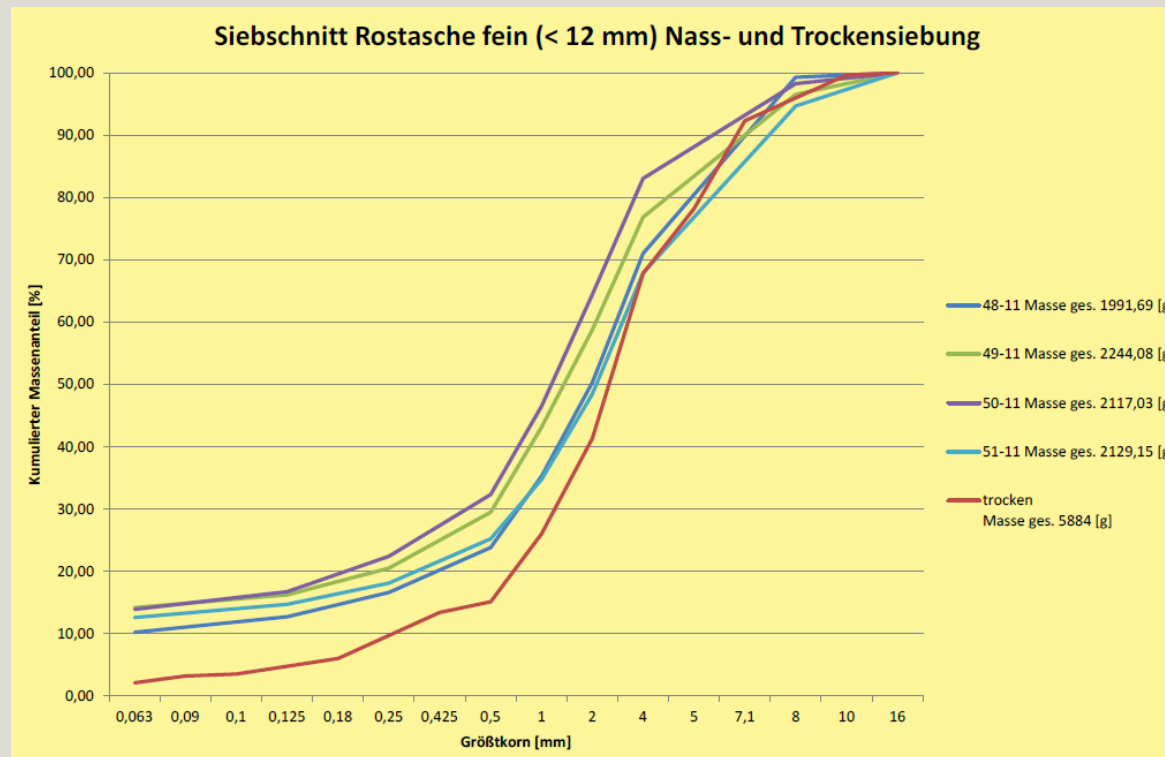
Gibbs Energies of different sulfide reaction per mol S



Gibbs Energies of different chloride reaction per mol Cl

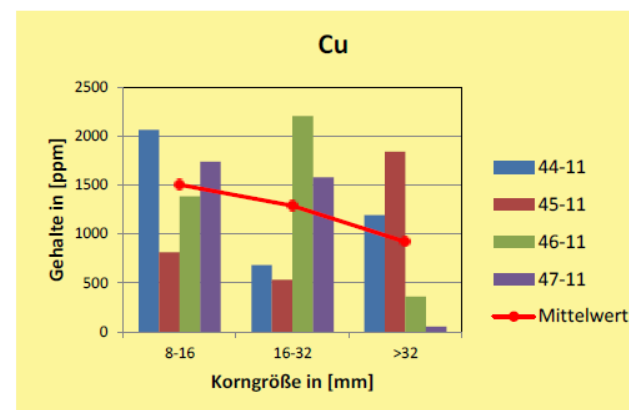
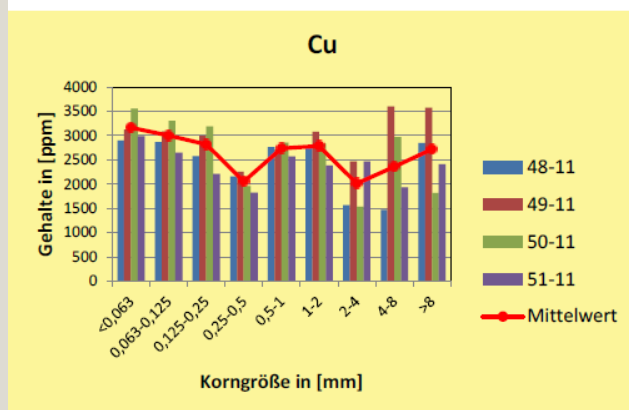
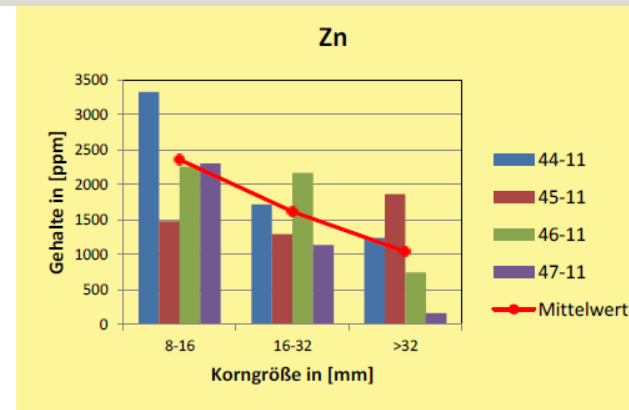
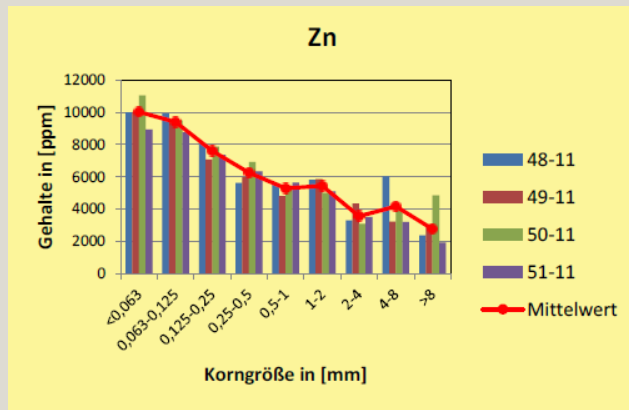


Particle size distribution curve of fine fraction of bottom ash



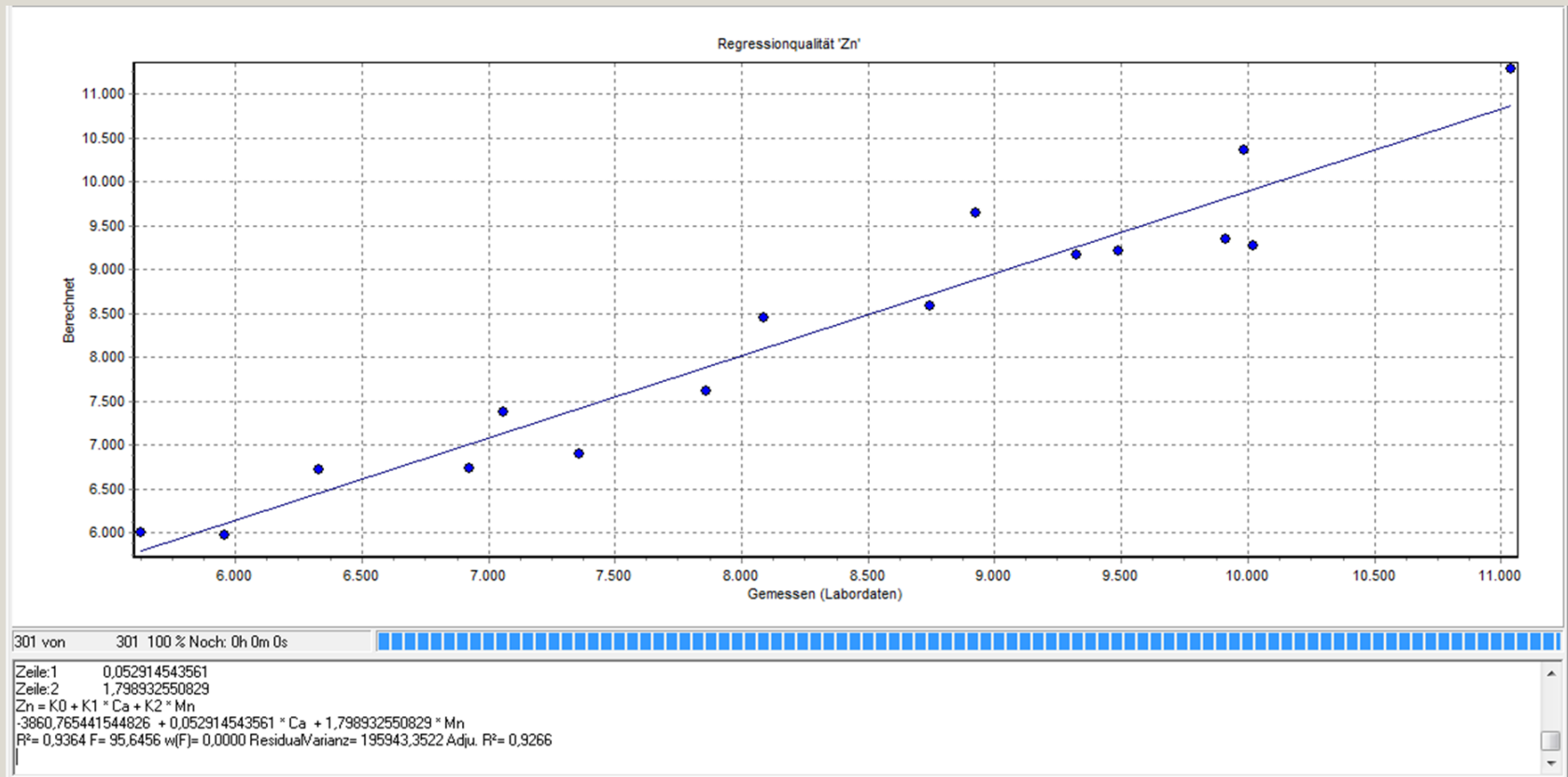
Deike, R.; Ebert, D.; Warnecke, R.; Vogell, M.: Abschlussbericht zum Projekt Recyclingpotenziale bei Rückständen aus der Müllverbrennung, www.itad/.de

Distribution of Zn and Cu depending on the particle size

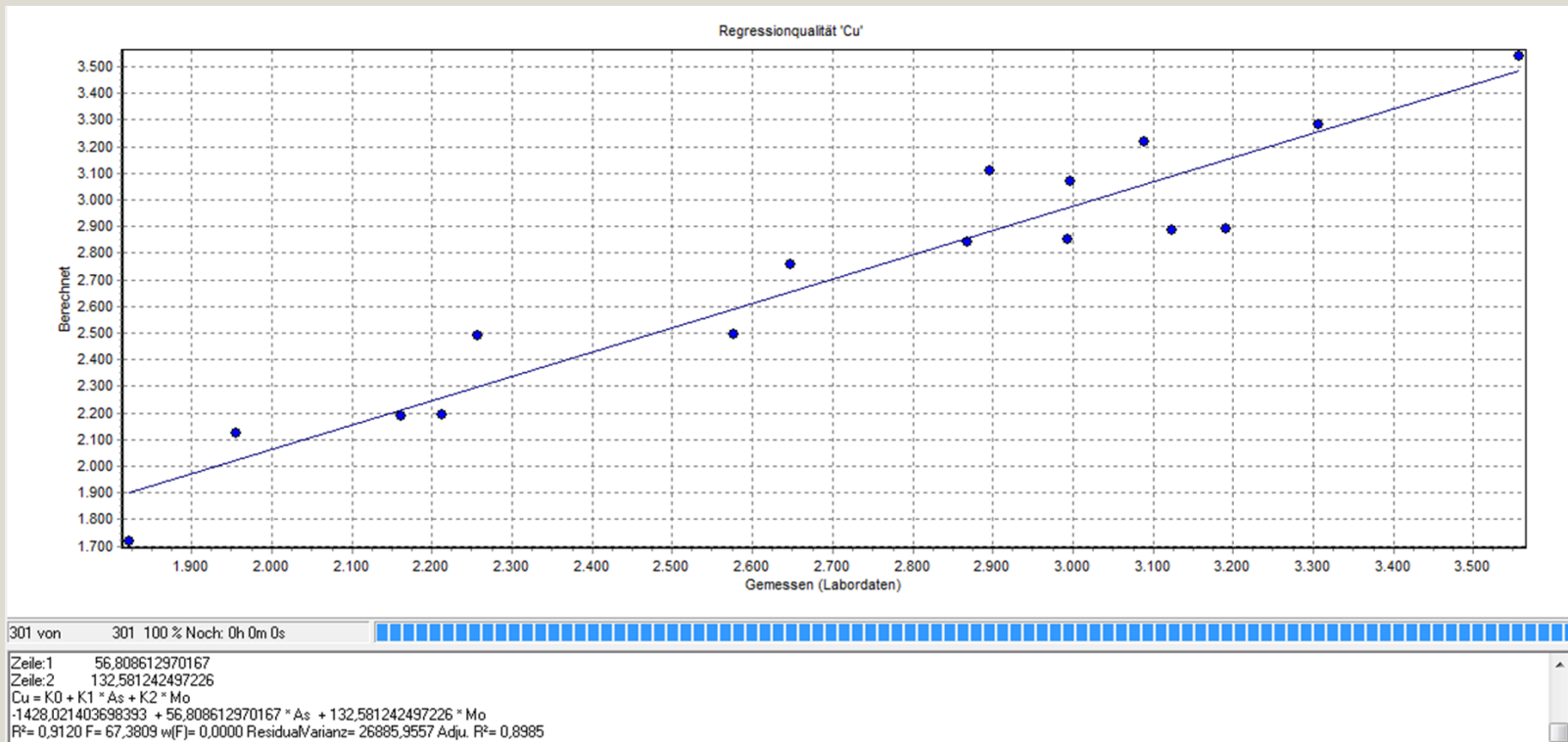


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Relation between Zn-, Ca- and Mn-content in fraction 0-0,5 mm



Relation between Cu-, As- and Mo-content in fraction 0-0,5 mm

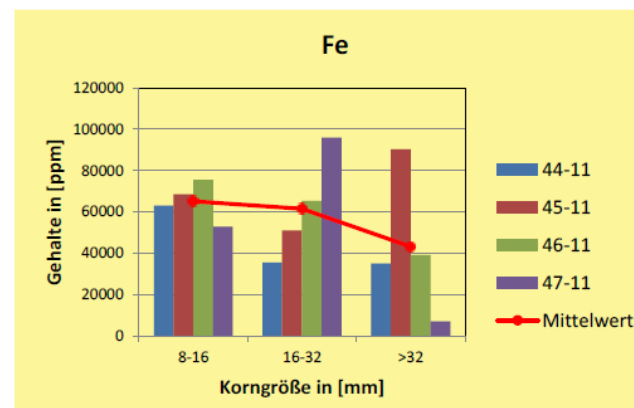
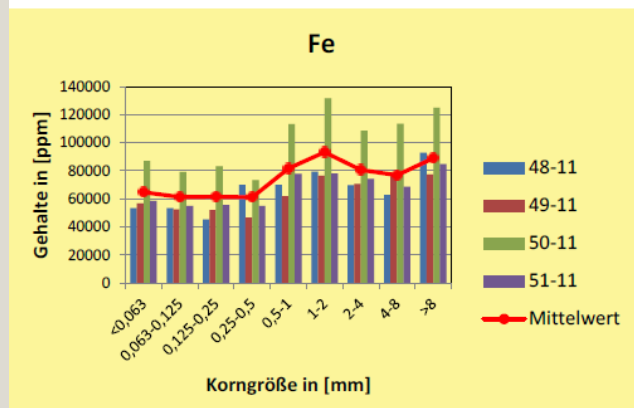
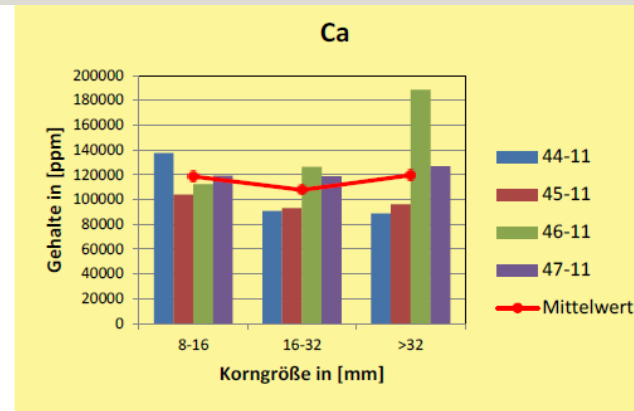
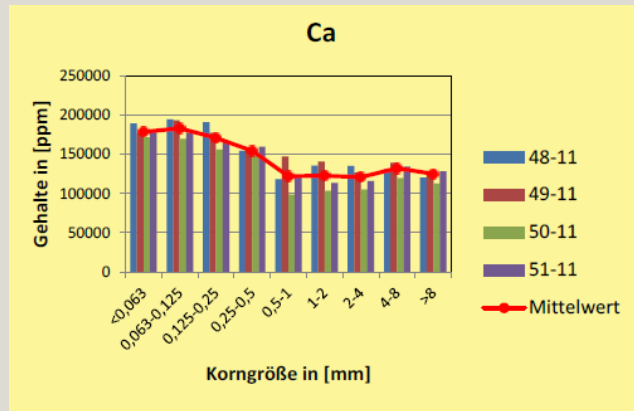


Metallic particles from dry bottom ash treatment



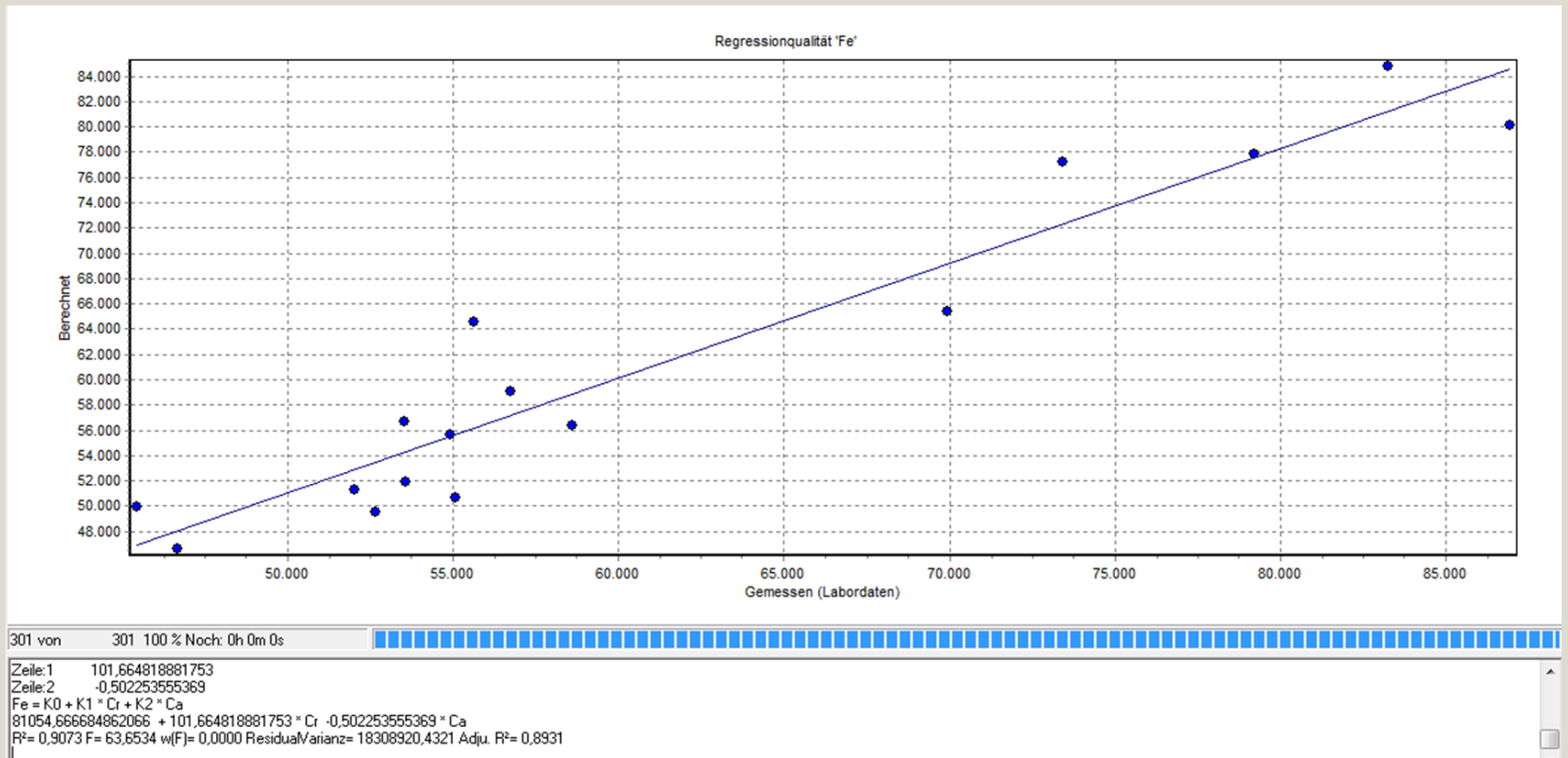
Deike, R., Brümmner, A.: Qualitätssicherung bei der Schlackenaufbereitung – neue Herausforderung, ZAR –Stiftung Zentrum für Nachhaltige Abfall- und Ressourcennutzung, Hinwil, 21.03.2012

Distribution of Ca and Fe depending on the particle size



Deike, R.; Ebert, D.; Warnecke, R.; Vogell, M.: Abschlussbericht zum Projekt Recyclingpotenziale bei Rückständen aus der Müllverbrennung, www.itad.de

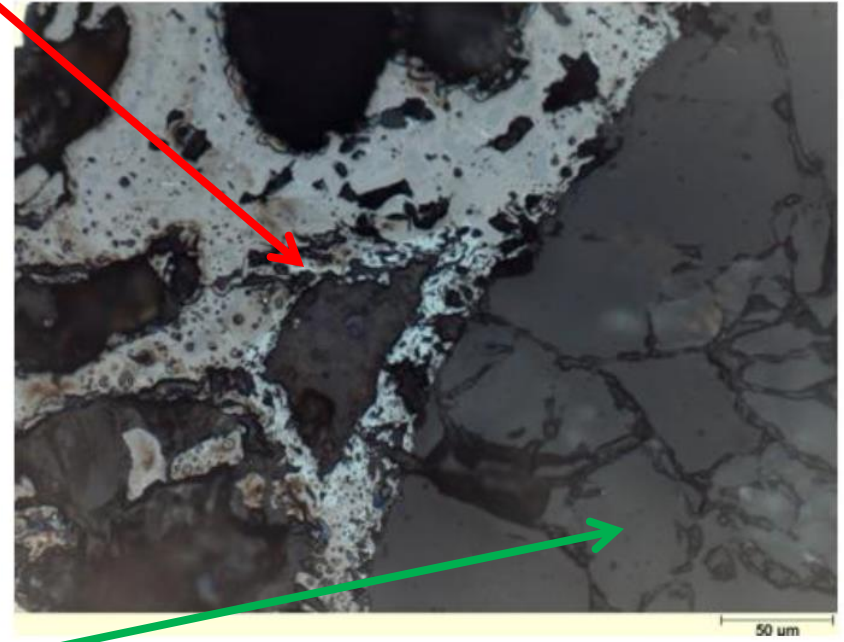
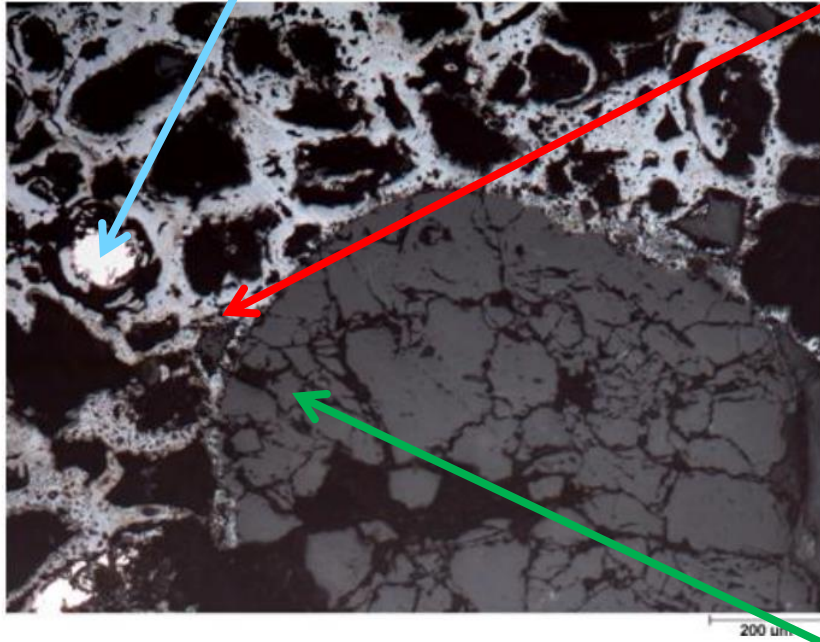
Relation between Fe-, Cr- and Ca-content in fraction 0-0,5 mm



Reaction between iron oxide and mineral phases

Metallic Iron

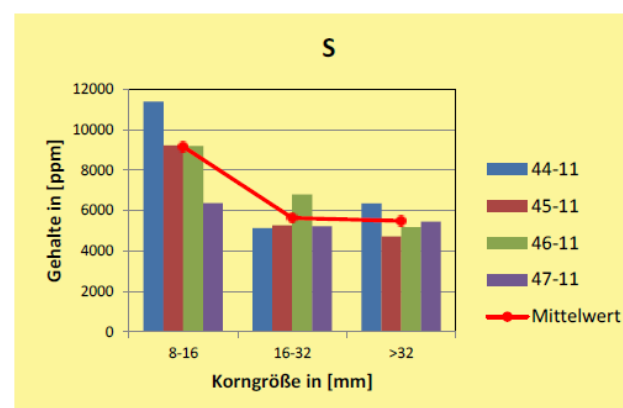
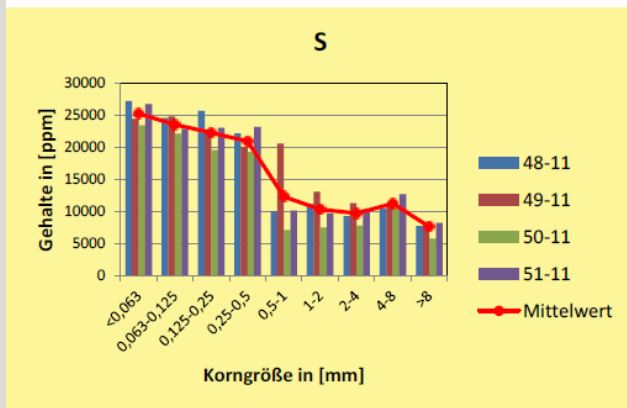
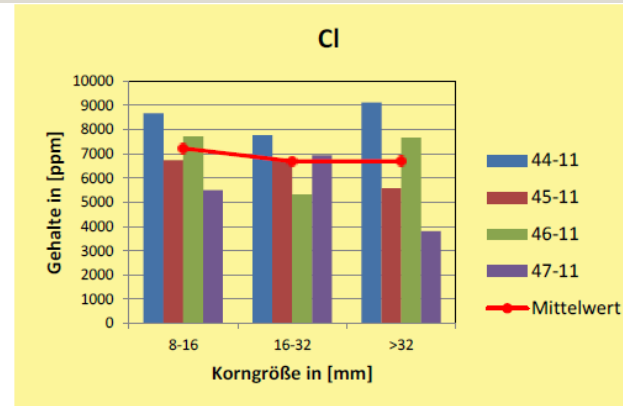
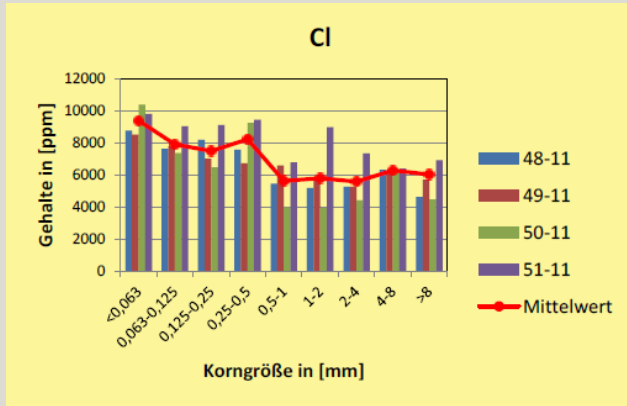
Iron oxide



Mineral phase

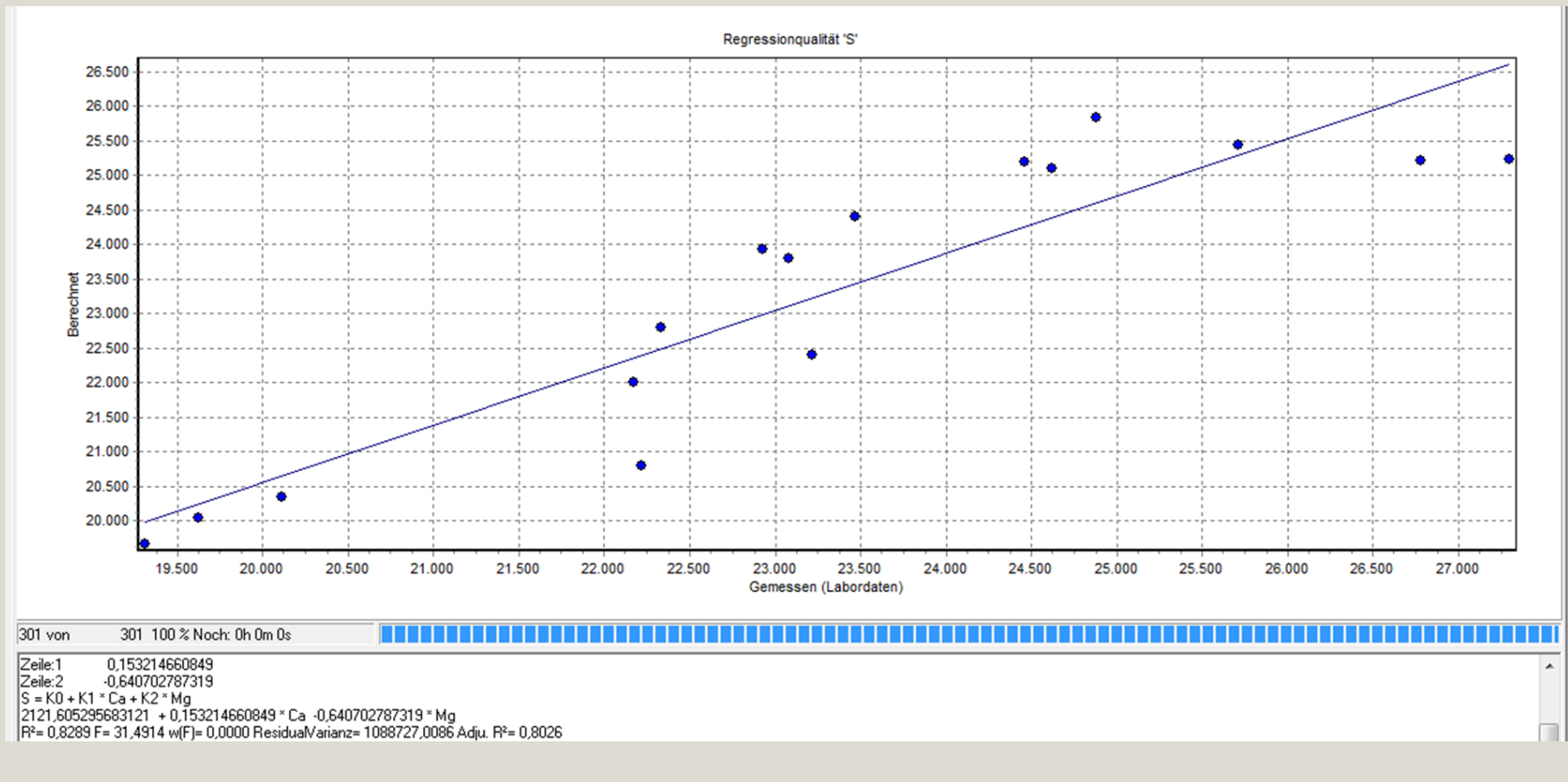
Deike, R.; Ebert, D.; Warnecke, R.; Vogell, M.: Abschlussbericht zum Projekt Recyclingpotenziale bei Rückständen aus der Müllverbrennung, www.itad.de

Distribution of Cl and S depending on the particle size

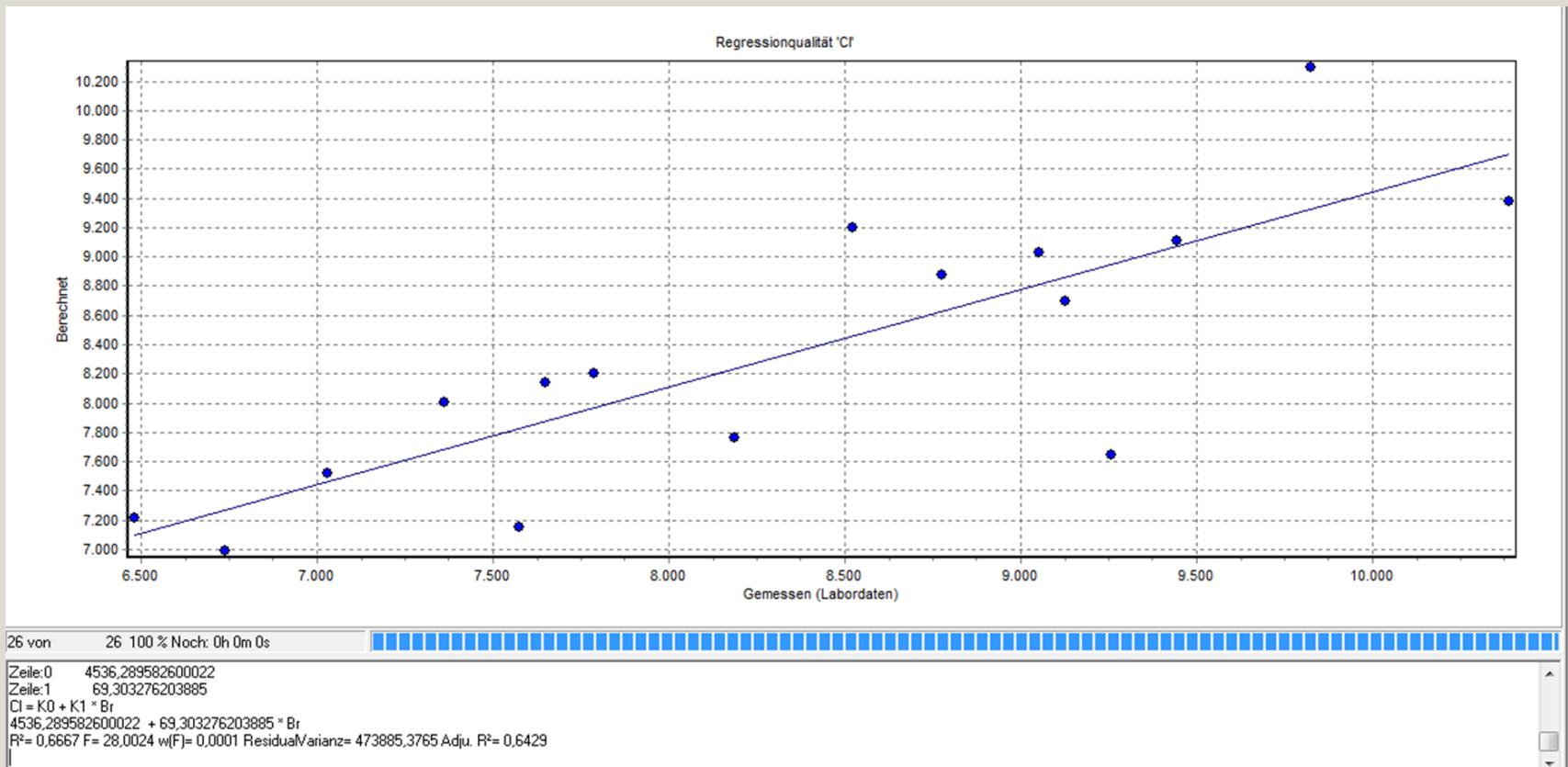


Deike, R.; Ebert, D.; Warnecke, R.; Vogell, M.: Abschlussbericht zum Projekt Recyclingpotenziale bei Rückständen aus der Müllverbrennung, www.itad.de

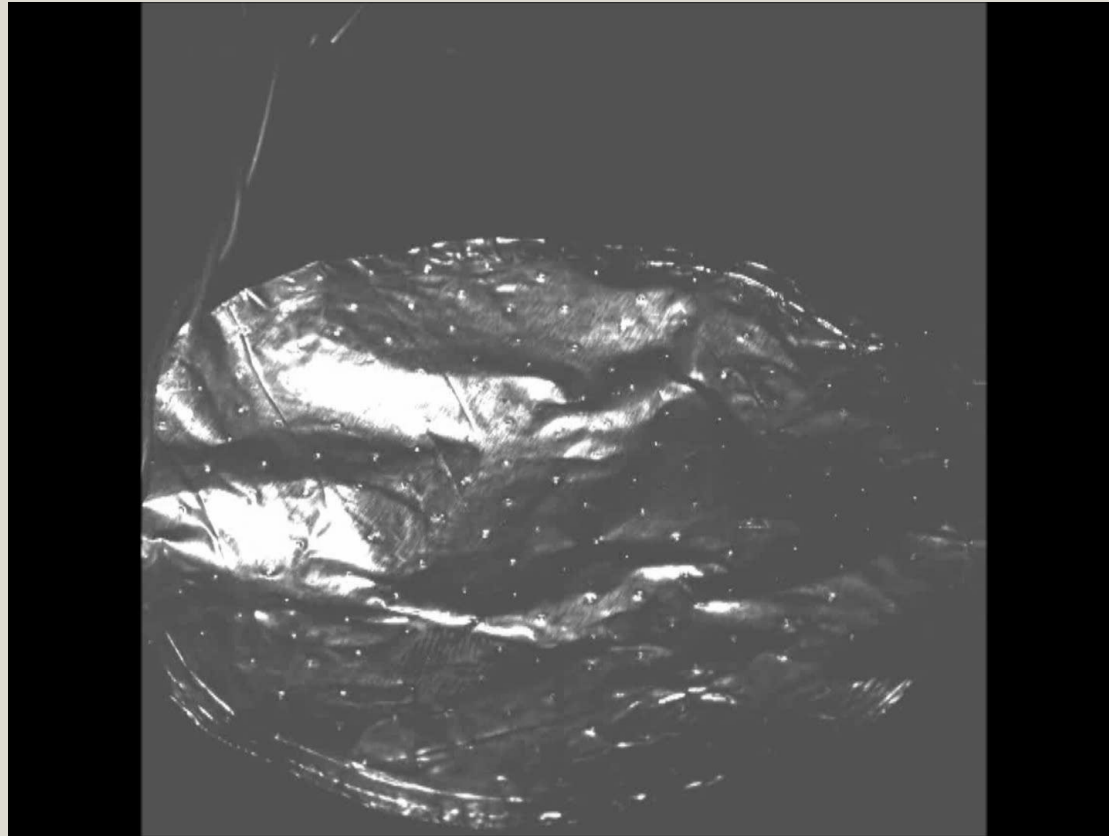
Relation between S-, Ca- and Mg-content in fraction 0-0,5 mm



Relation between Cl- and Br-content in fraction 0-0,5 mm

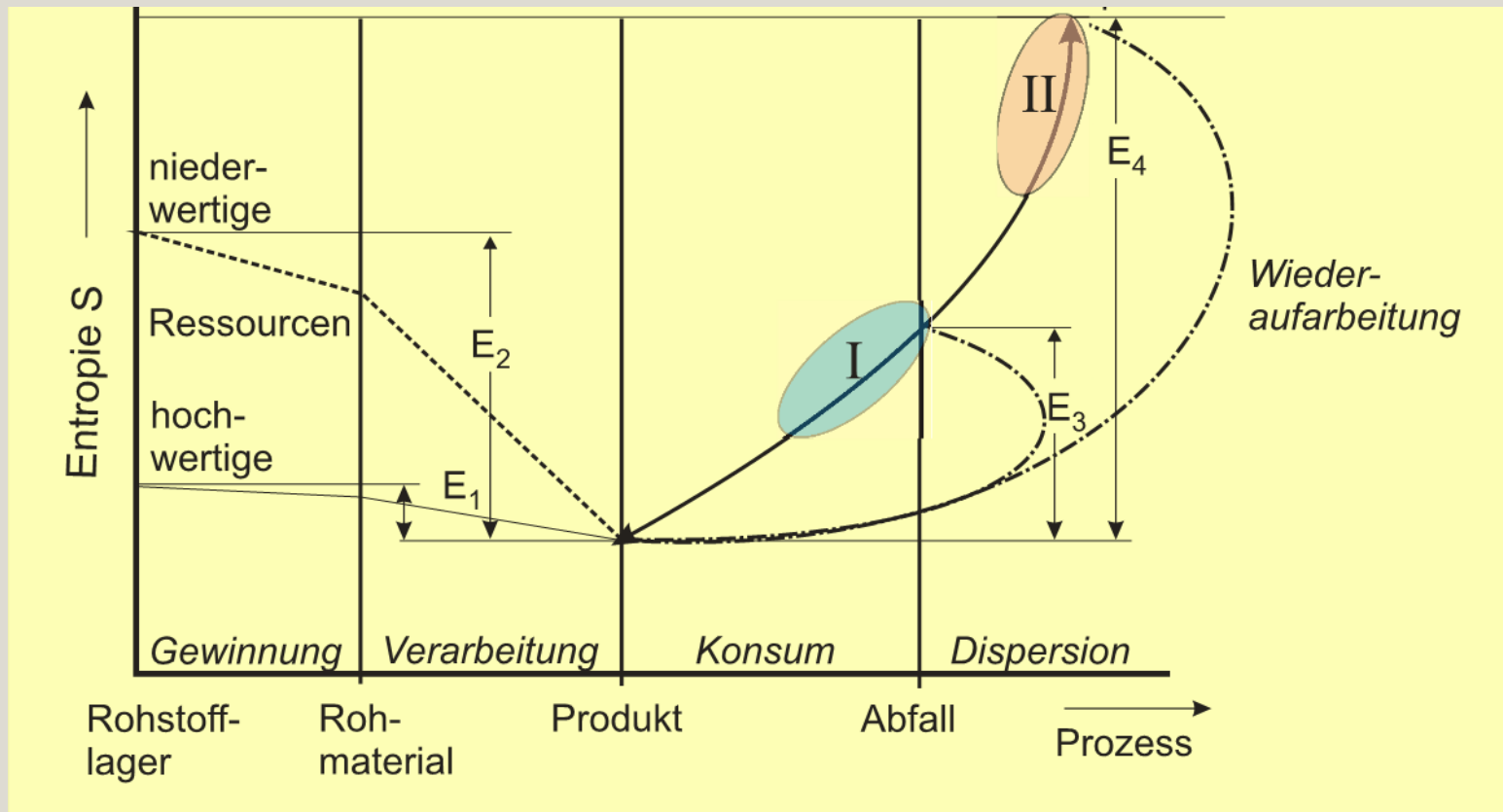


Behaviour of Aluminium at high temperatures



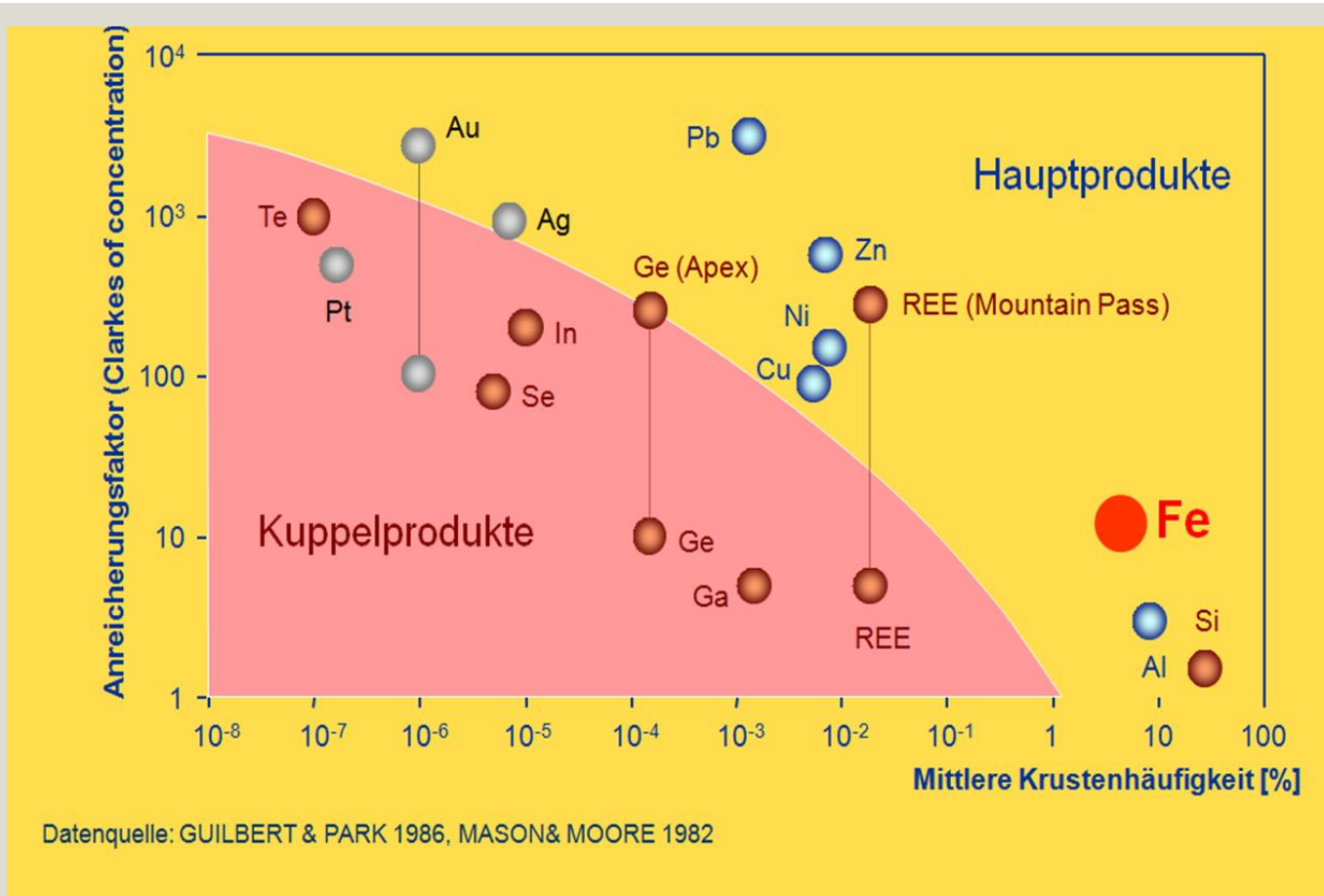
Deike, R.; Ebert, D.; Schubert, D.; Ulum, R.; Warnecke, R.; Vogell, M.: Berliner Schlackenkonferenz, Berlin 23.09.2013

Entropy development from ore to product to waste



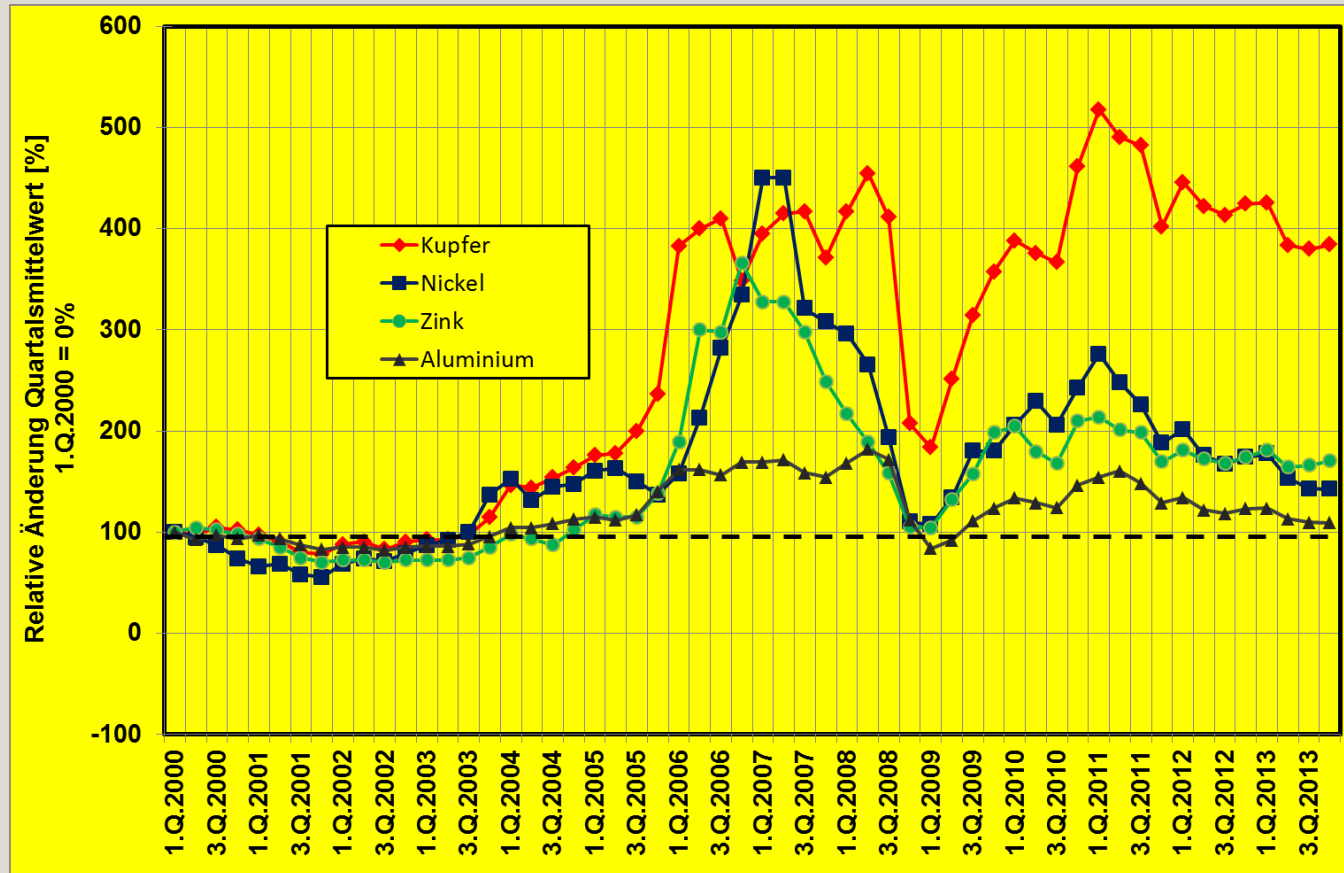
Esser, R.: Thermodynamische Aspekte der Abfallverwertung, AbfallwirtschaftsJournal, vol 4, pp.227-238, 1992.

Distribution of elements as average values in earth's crust and concentrated in ores



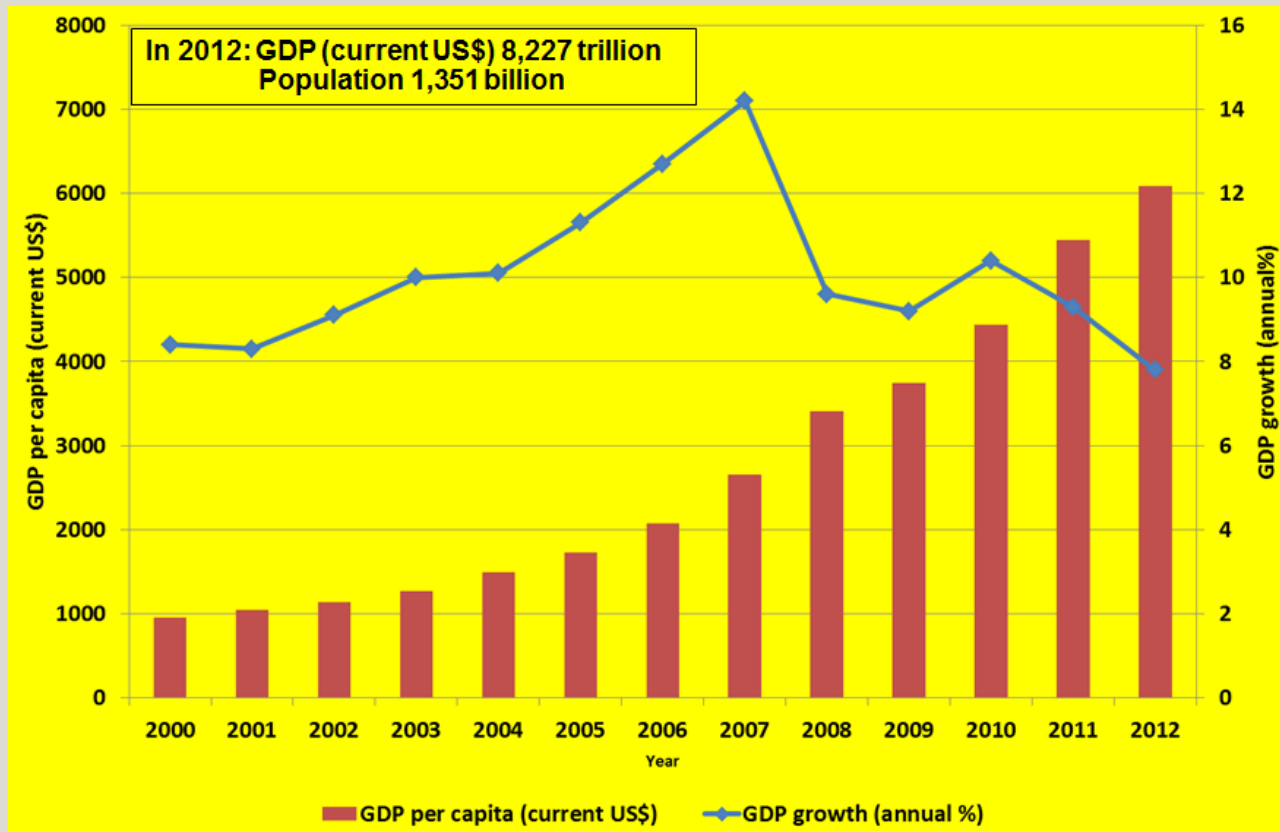
Stribny, B.; Wagner, M.: Geowissenschaftliche Aspekte der Verfügbarkeit von Rohstoffen für die Stahlindustrie, Stahltag, Düsseldorf 10./11.11.2005

Price changes of metals



Nach Daten www.lme.com

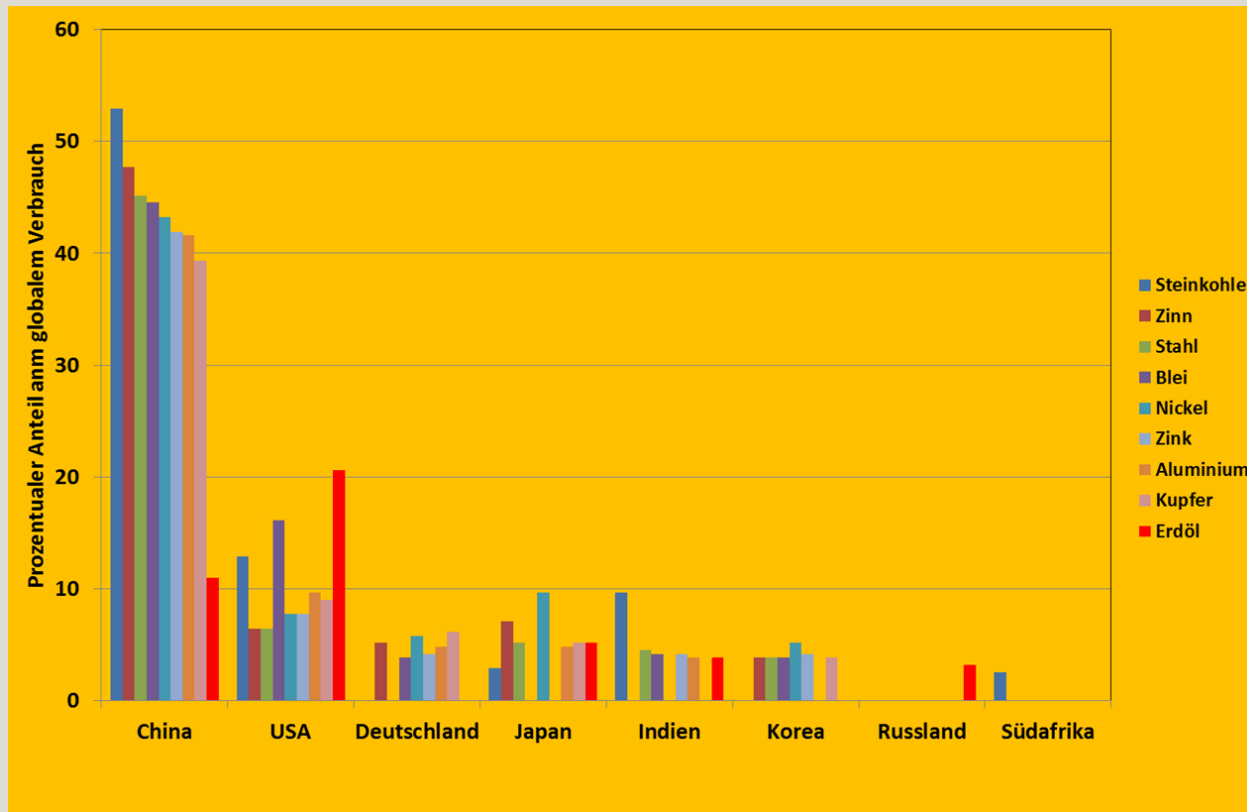
Development of Gross Domestic Product in China



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

Deike, R.: ZVEI-IZT Workshop, Berlin 19.02.2014

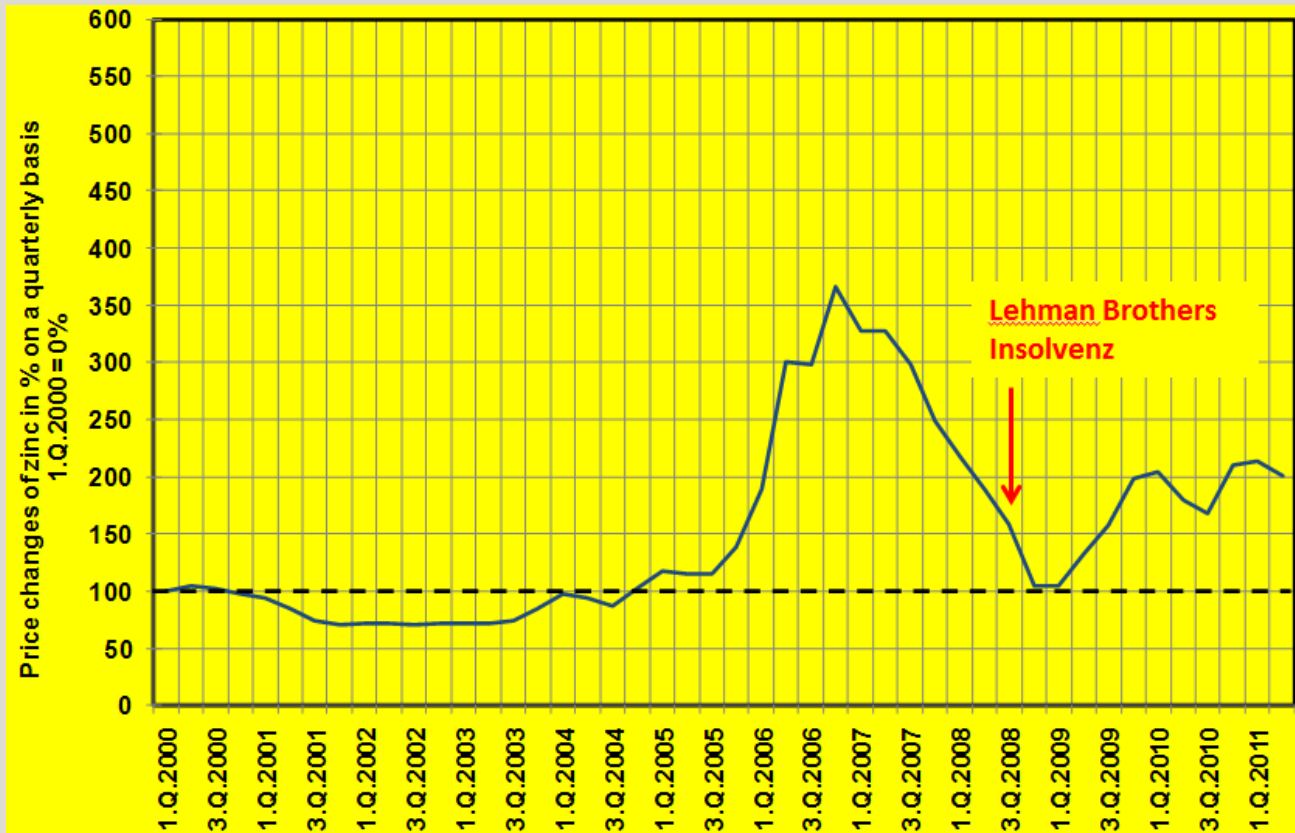
Most important countries in consuming raw materials in 2011



Nach Daten DERA: Deutschland Rohstoffsituation 2011, www.bgr.bund.de

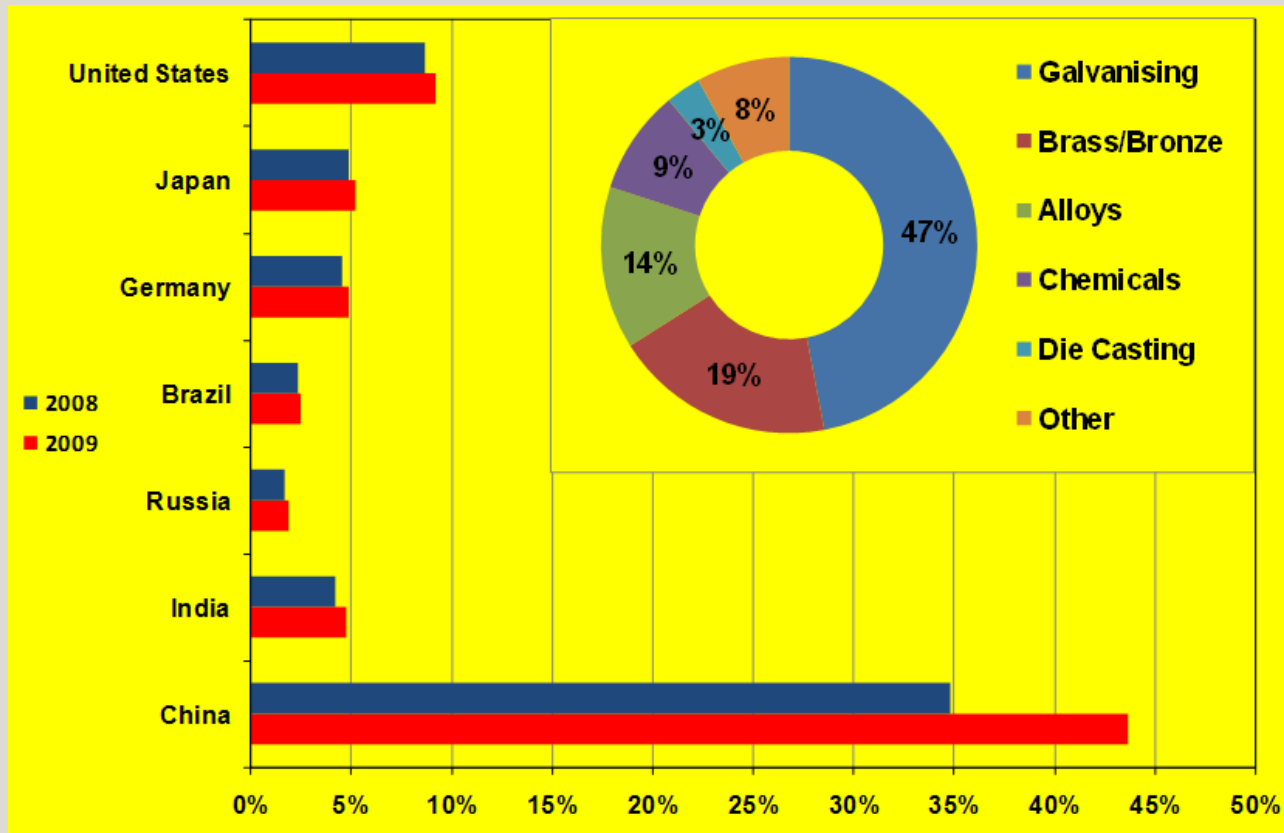
Deike, R.; Ebert, D.; Schubert, D.; Ulum, R.; Warnecke, R.; Vogell, M.: Berliner Schlackenkonferenz, Berlin 23.09.2013

Zinc prices started to drop down one year before global economic crisis has been officially announced



Deike, R.: Moerser Universitätwochen, Moers 06.10.2011

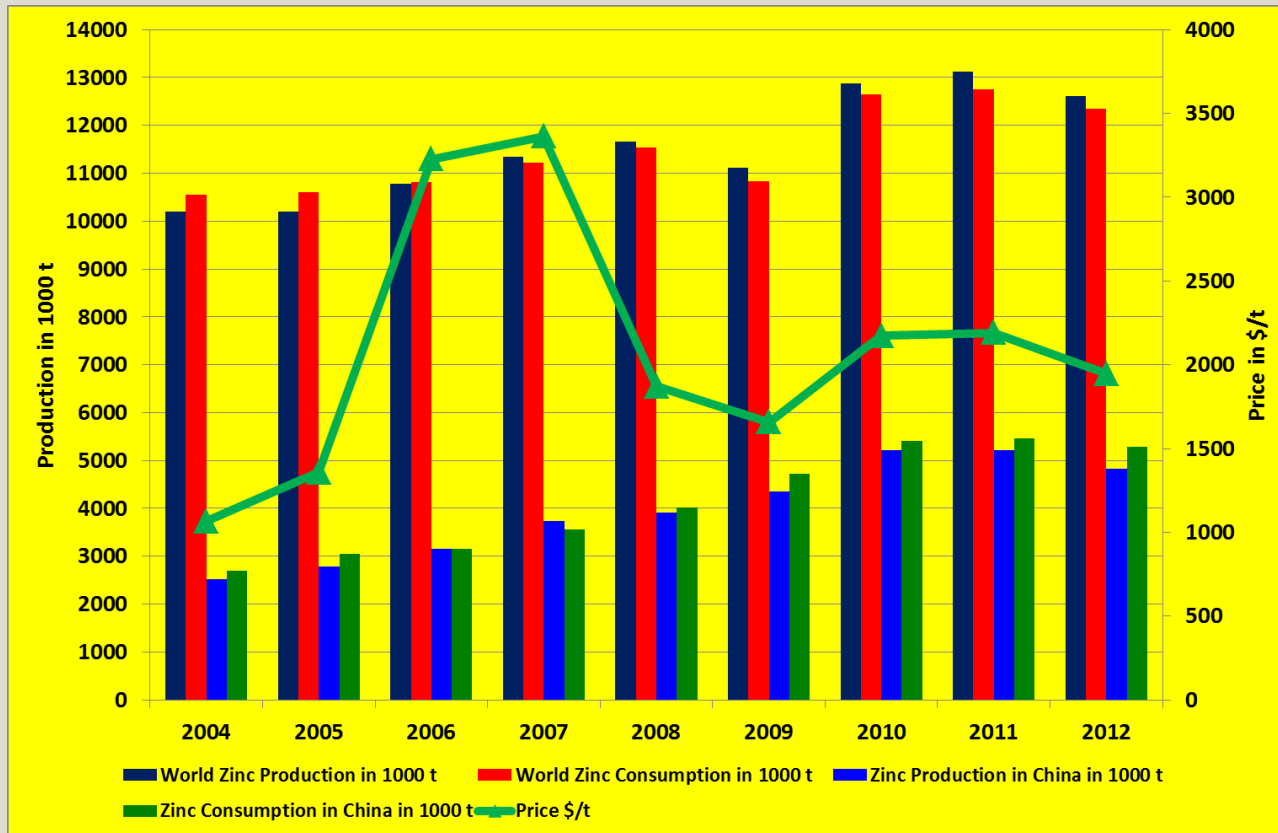
Global zinc consumption in 2008 /2009 (11,5 / 10,8 Mio. t) considering different region and zinc consuming industries



Nach Daten BGR: www.bgr.bund.de

Deike, R.: Moerser Universitätswochen, Moers 06.10.2011

Development of Global and Chinese zinc production, consumption and resulting price changes from 2004 to 2012



Nach Daten BGR: www.bgr.bund.de

Thank you for your attention!