XII Hamburger Abfallwirtschaftstage

TUHH IUE

MVA-Schlackeaufbereitung: Metallrückgewinnung, Verwertung und Beseitigung der mineralischen Fraktion

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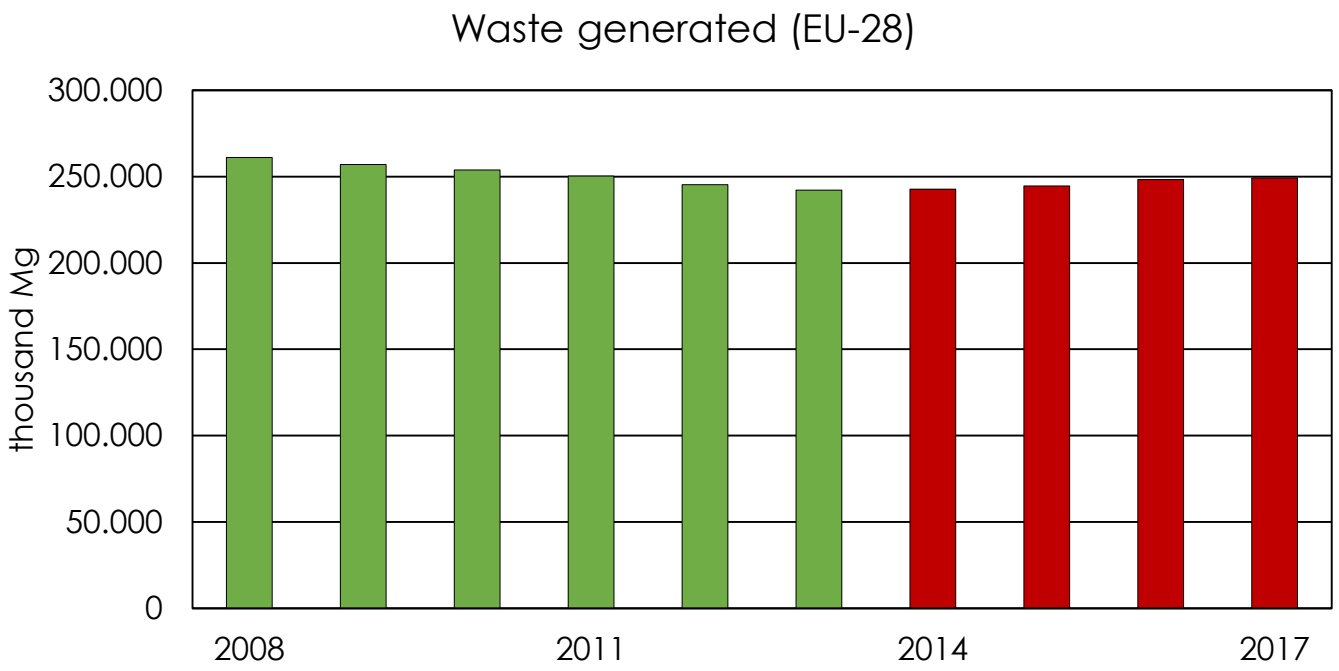
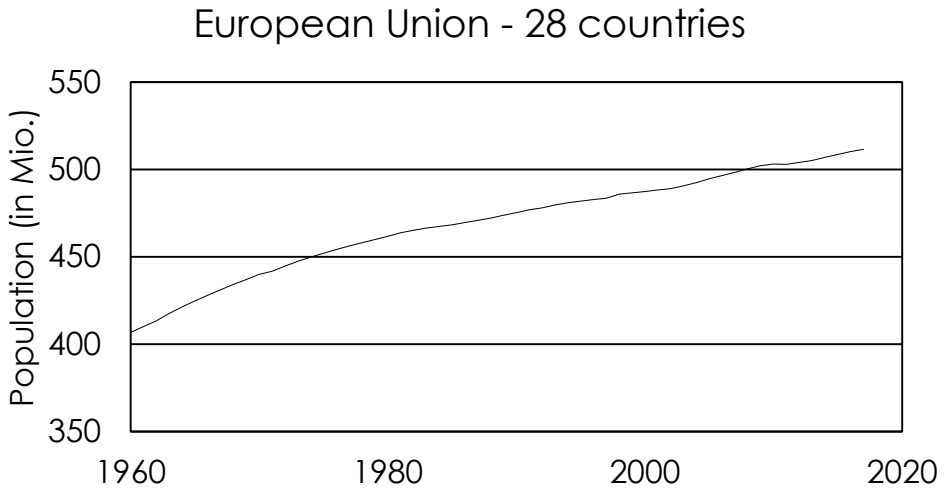
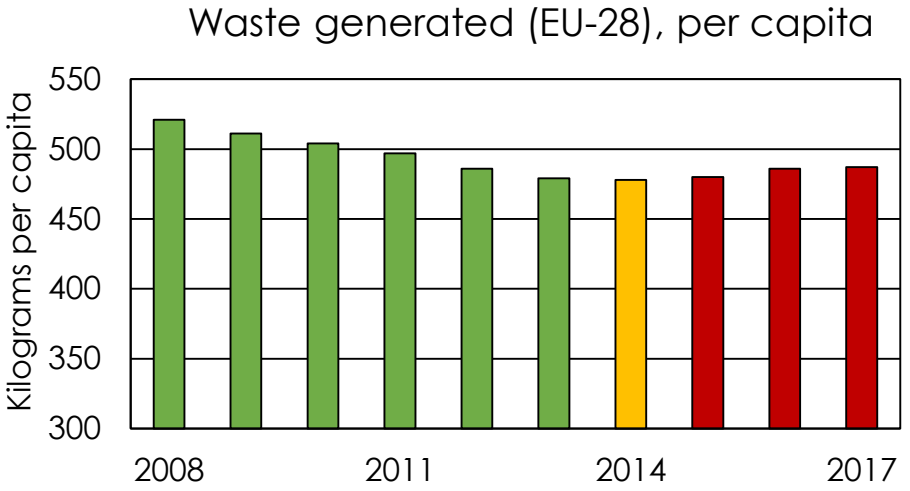
15.01.2020

EU-Siedlungsabfallaufkommen

Siedlungsabfälle[1] (Haushalte, Handelsaktivitäten und öffentliche Einrichtungen)

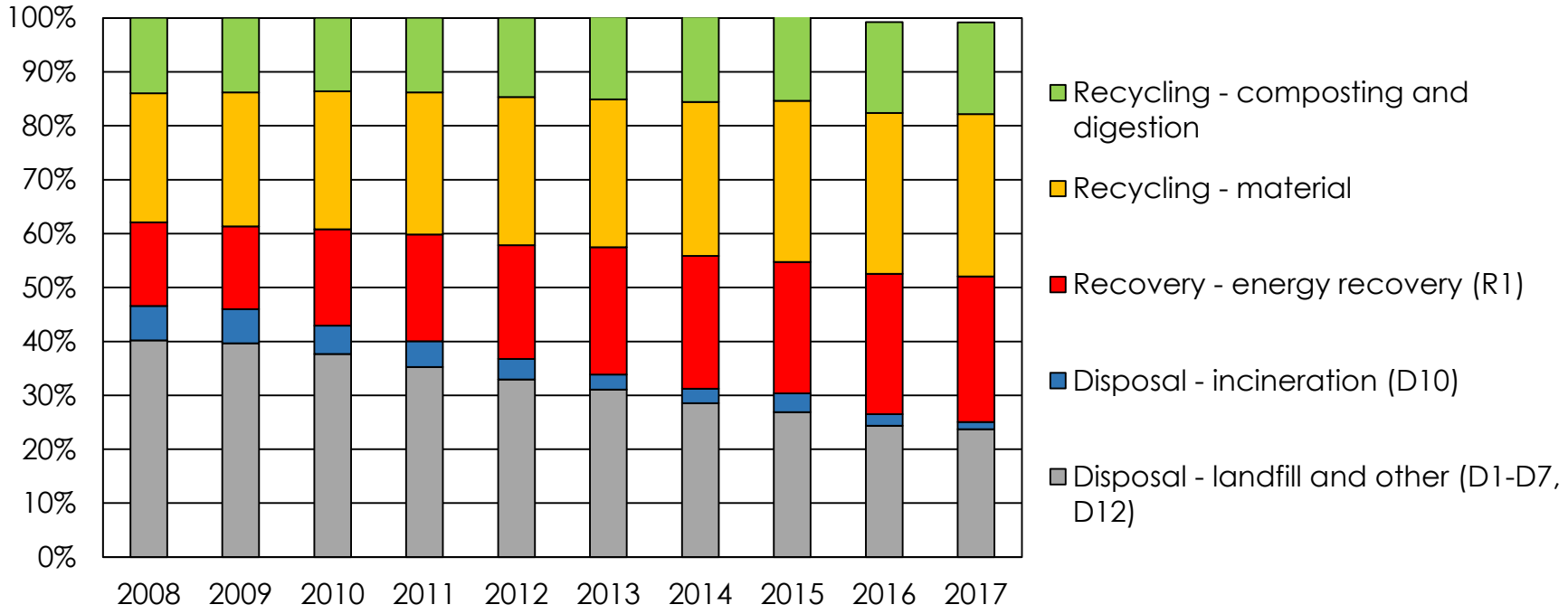




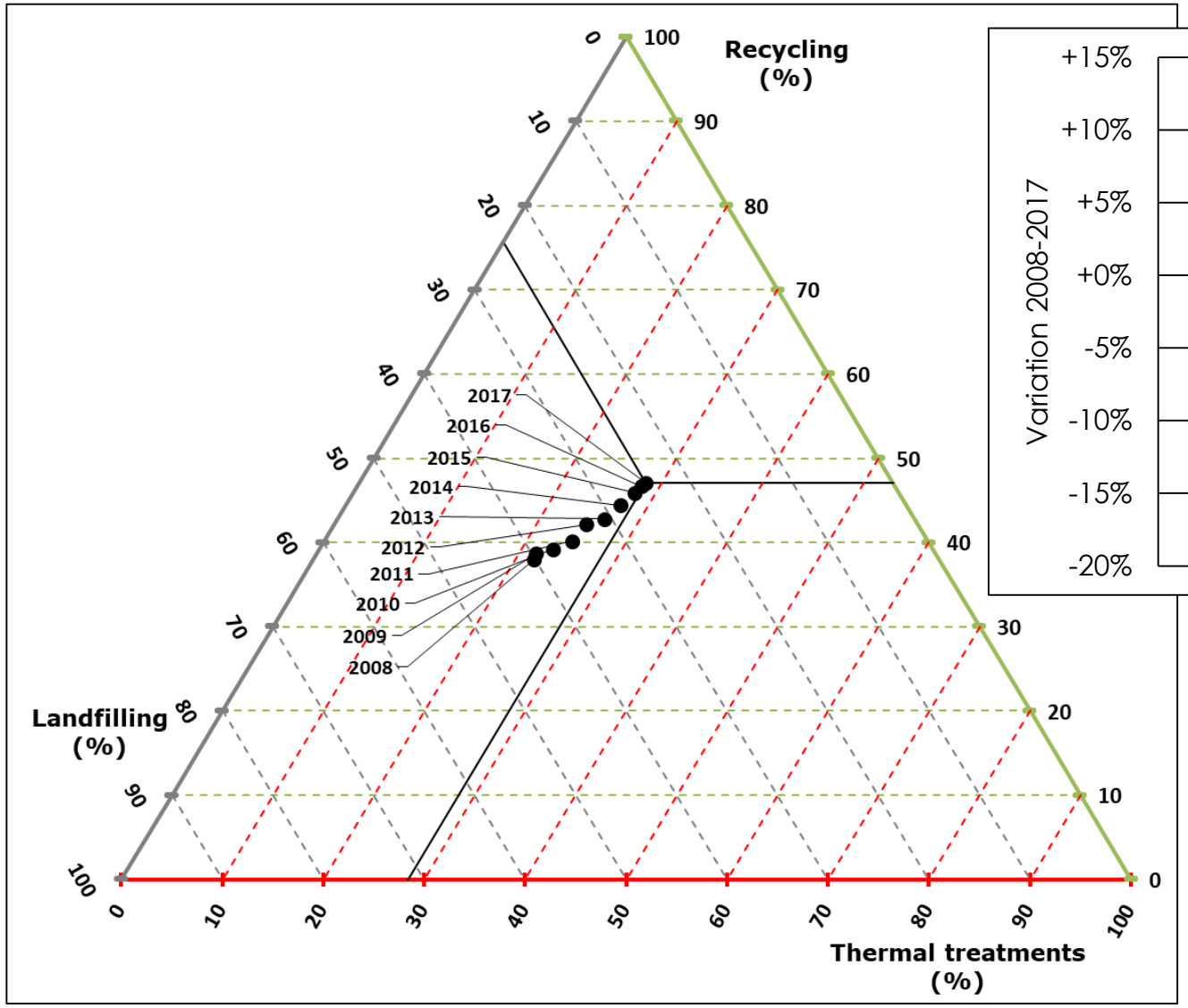


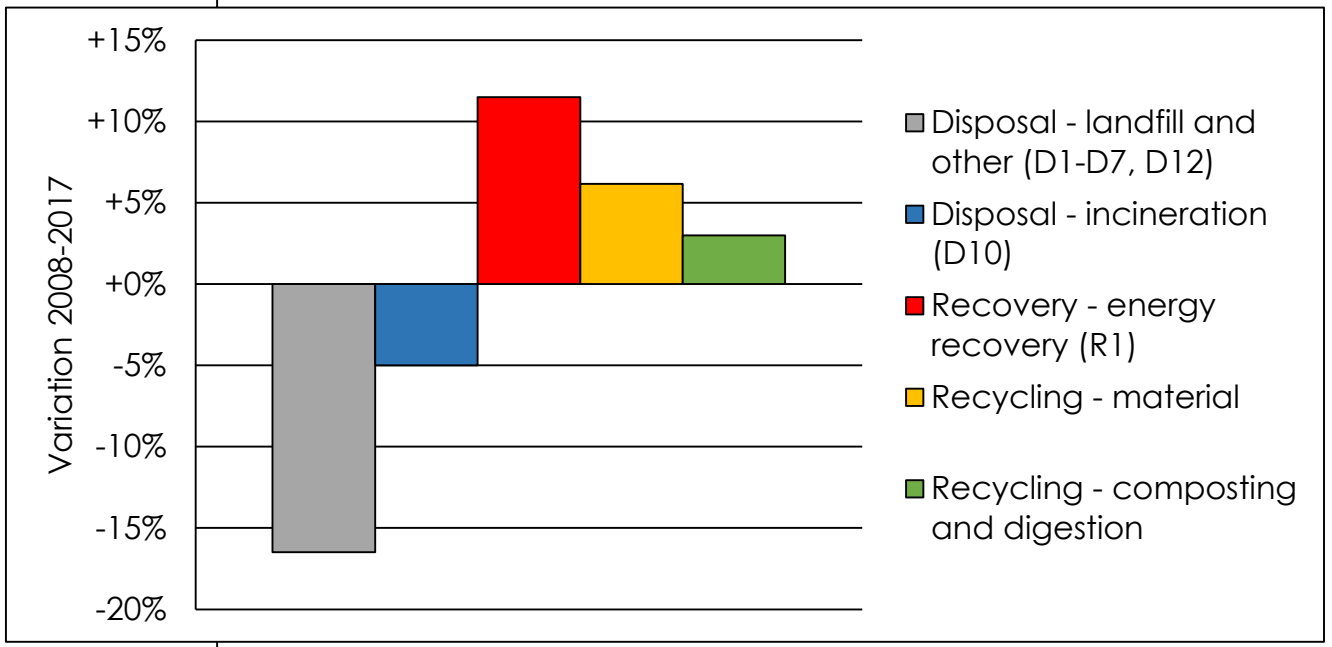
Angewandte Verfahren (WFD 2008/98/EC)[2]

- **Deponierung**: von D1 bis D7, und D12
- **Thermische Verfahrens**: D10 (Verbrennung) und R1 (Waste-to-Energy)
- **Recycling**: von R3 bis R5

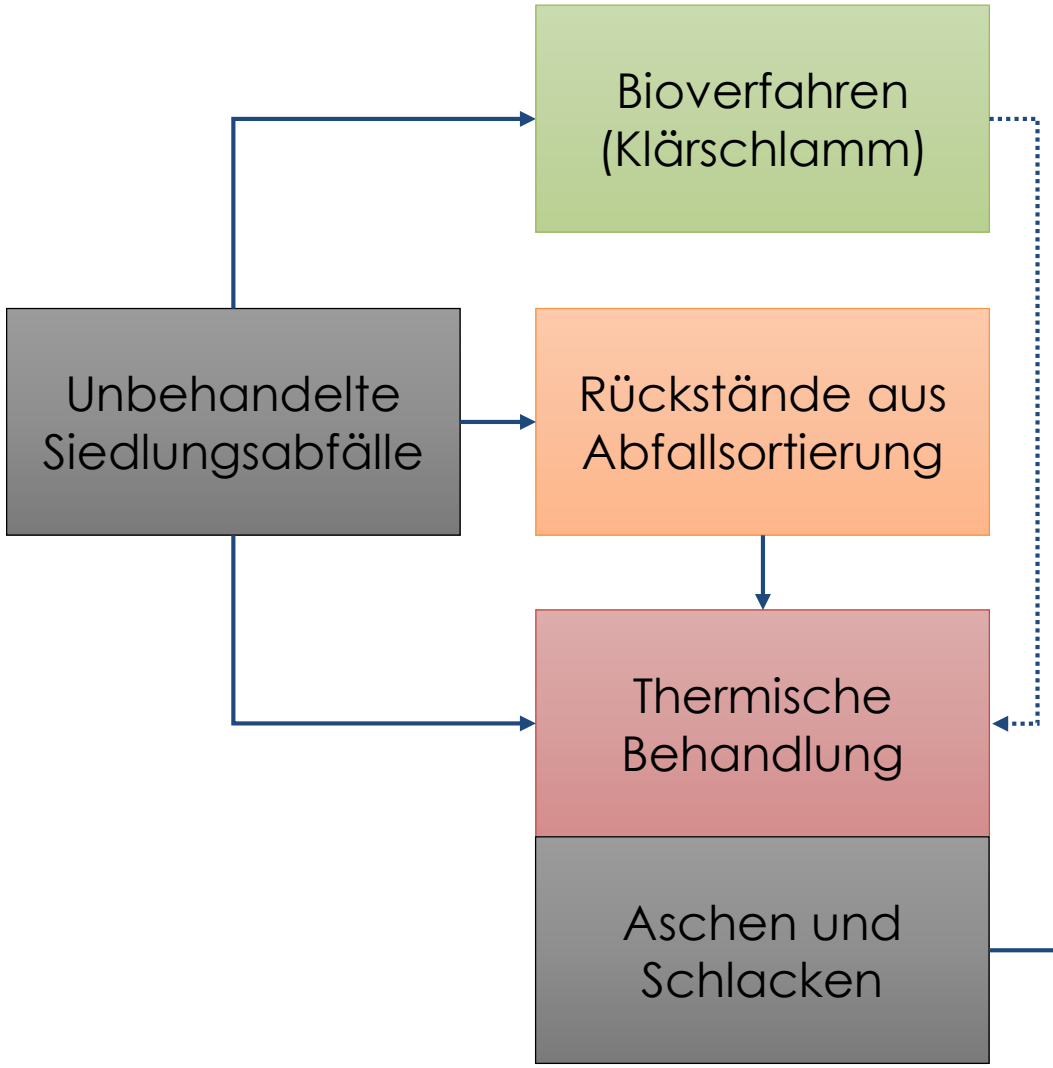


EU Siedlungsabfälle - Behandlung





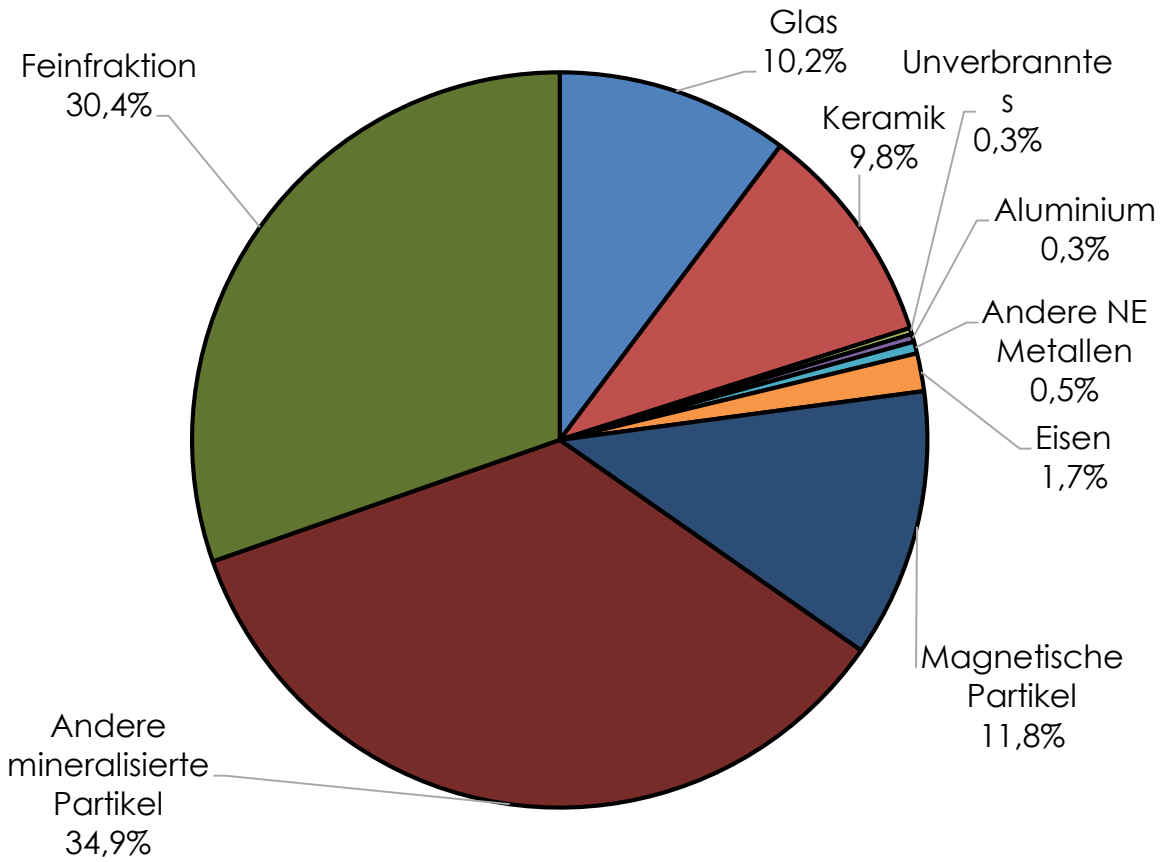
Mülldeponie von heute



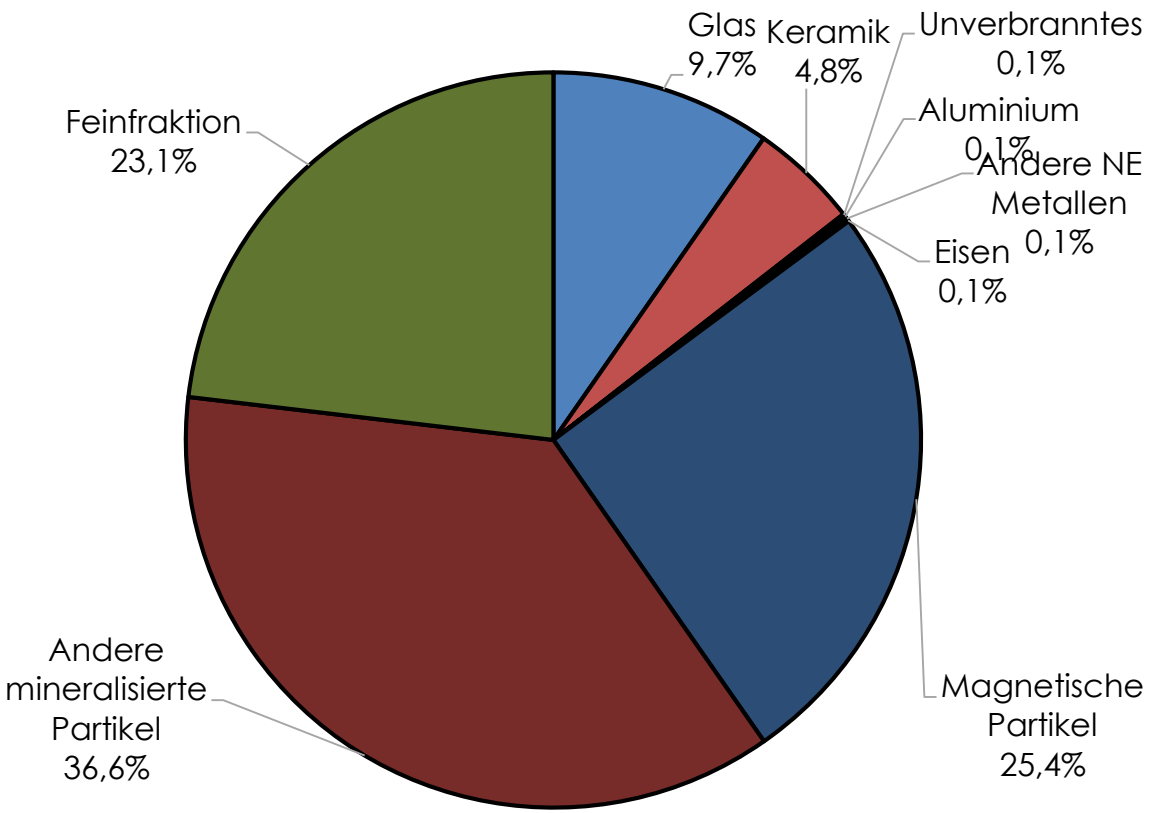
Materialien und Methoden

- Mineralienproben aus zwei Ländern
  - Deutschland
  - Schweden
- Kaskadenanalyse (d < 40 mm)
  - Wassergehalt
  - Partikelgrößenverteilung
    - 2 – 3.15 mm; 3.15 – 5 mm; 5 – 6.3 mm; 6.3 – 10 mm; 10 – 20 mm; > 20 mm
  - Material-Handsortierung für jede Größenklasse
    - Glas
    - Keramik
    - Magnetische Partikel (Eisenoxide)
    - Andere mineralisierte Partikel
    - Metalle (Eisen-, Nichteisen- und Aluminium)
    - Unverbranntes Material

Zusammensetzung (0 – 40 mm)

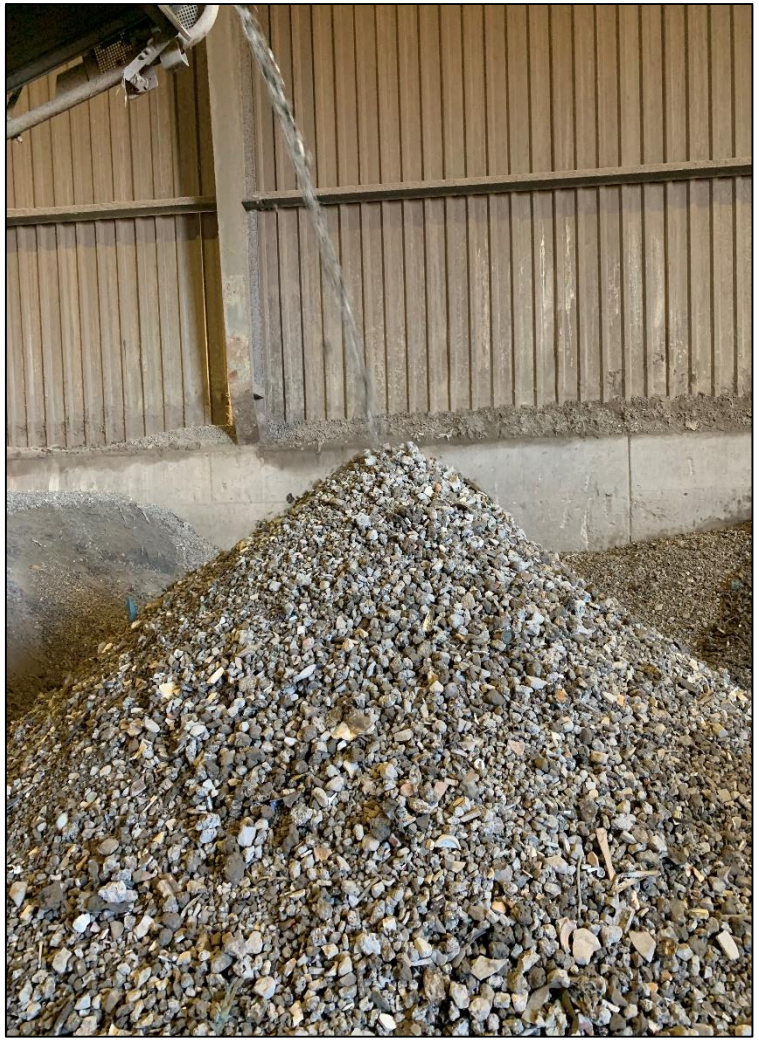


A1 - Deutschland

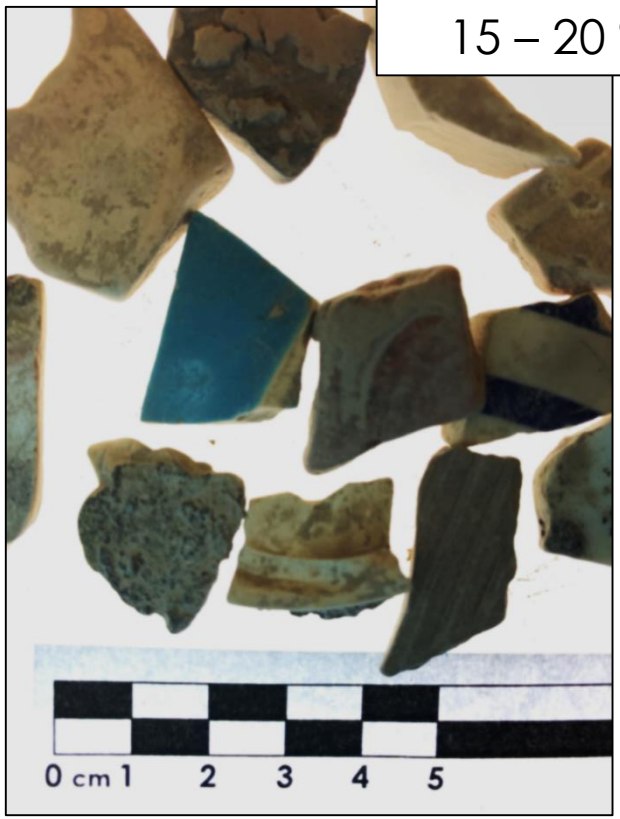


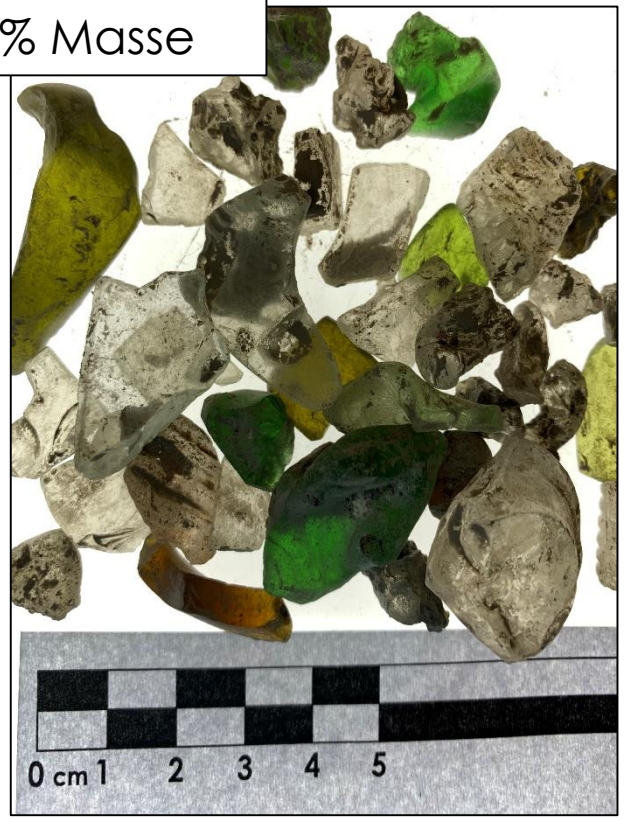
A2 - Schweden

Aschen Aufgliederung

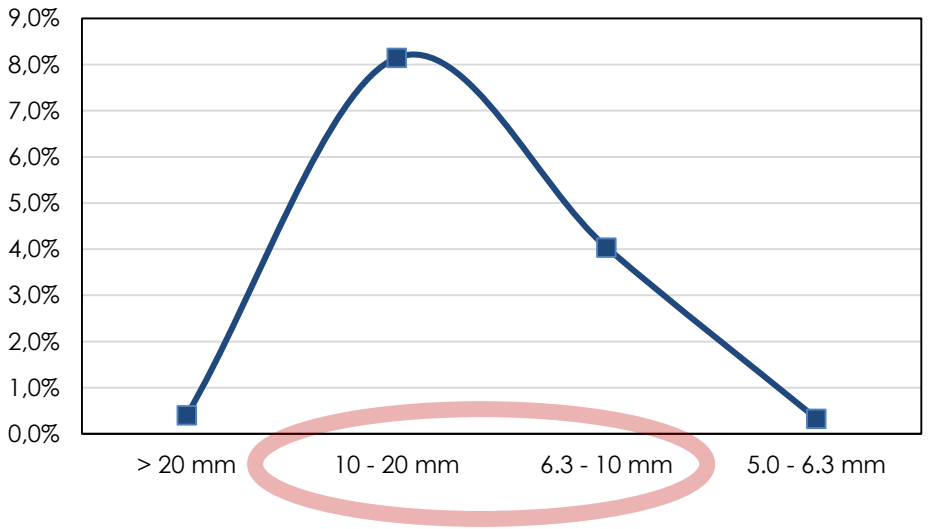


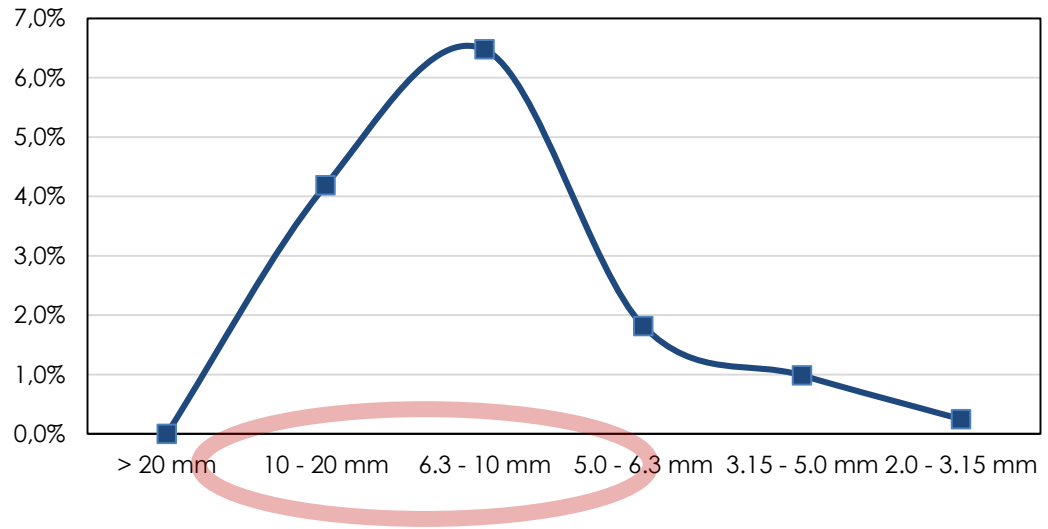
Refraktär Werkstoffe
15 – 20 % Masse



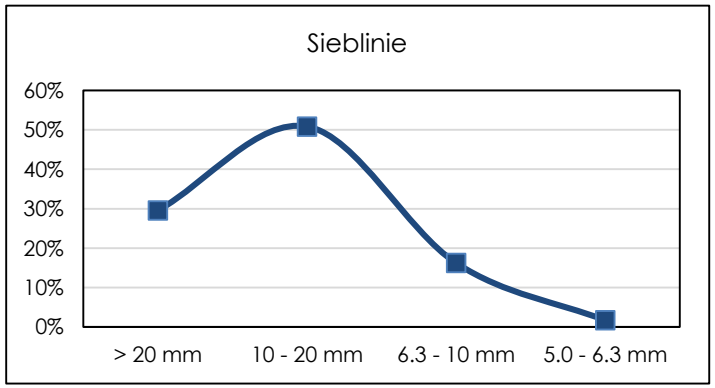


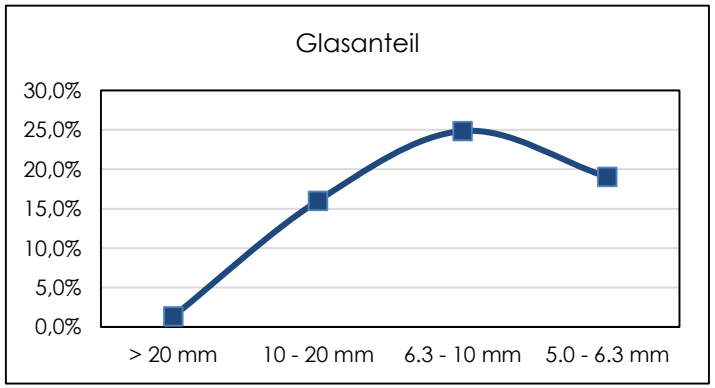
Glas Aufteilung



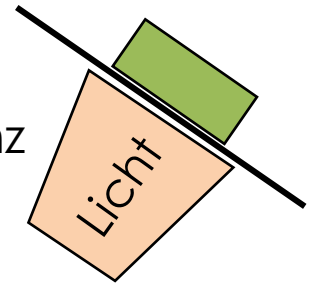


$$Glas = \text{Sieblinie} \times \text{Glasanteil}$$



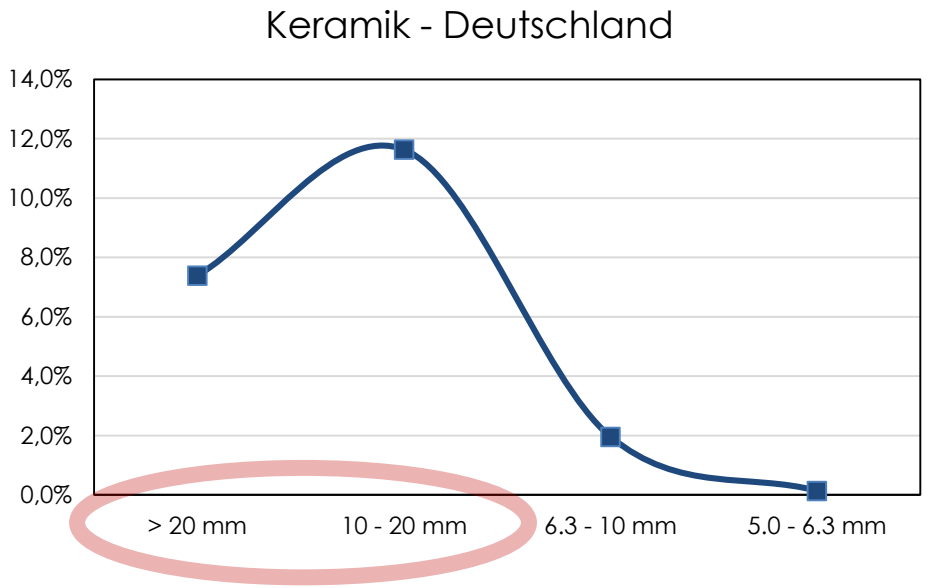


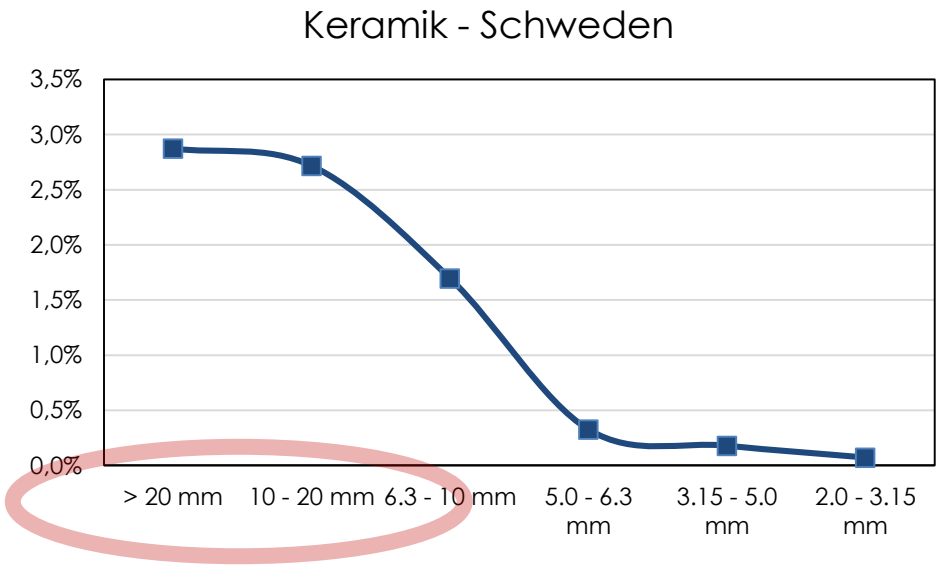
Handsortierung
nach Transparenz



UV-A/VIS (RGB) Transmission

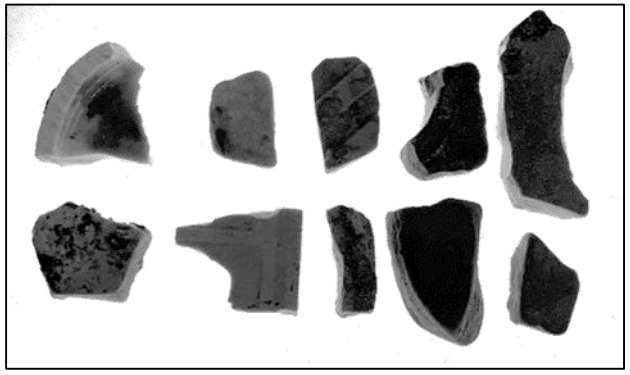
Keramik Aufteilung

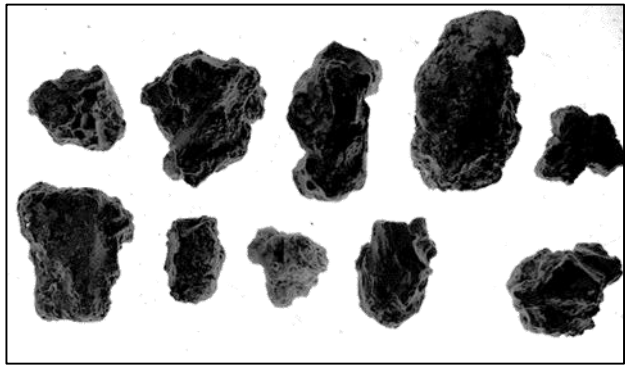




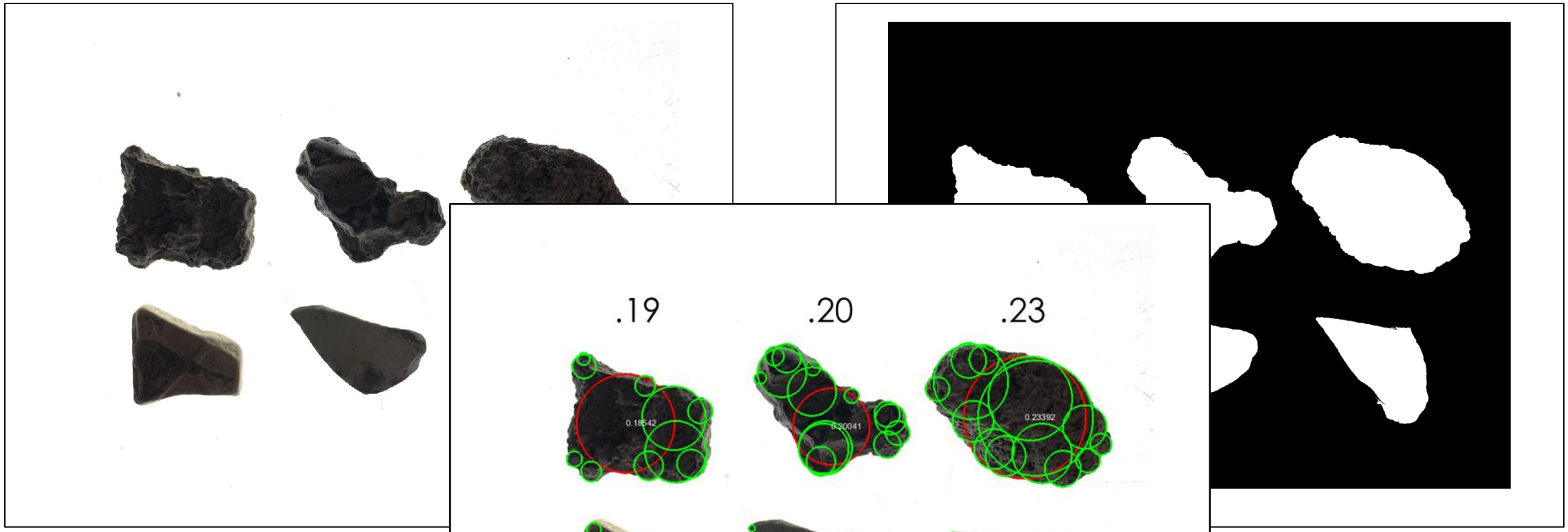
Handsortierung nach:

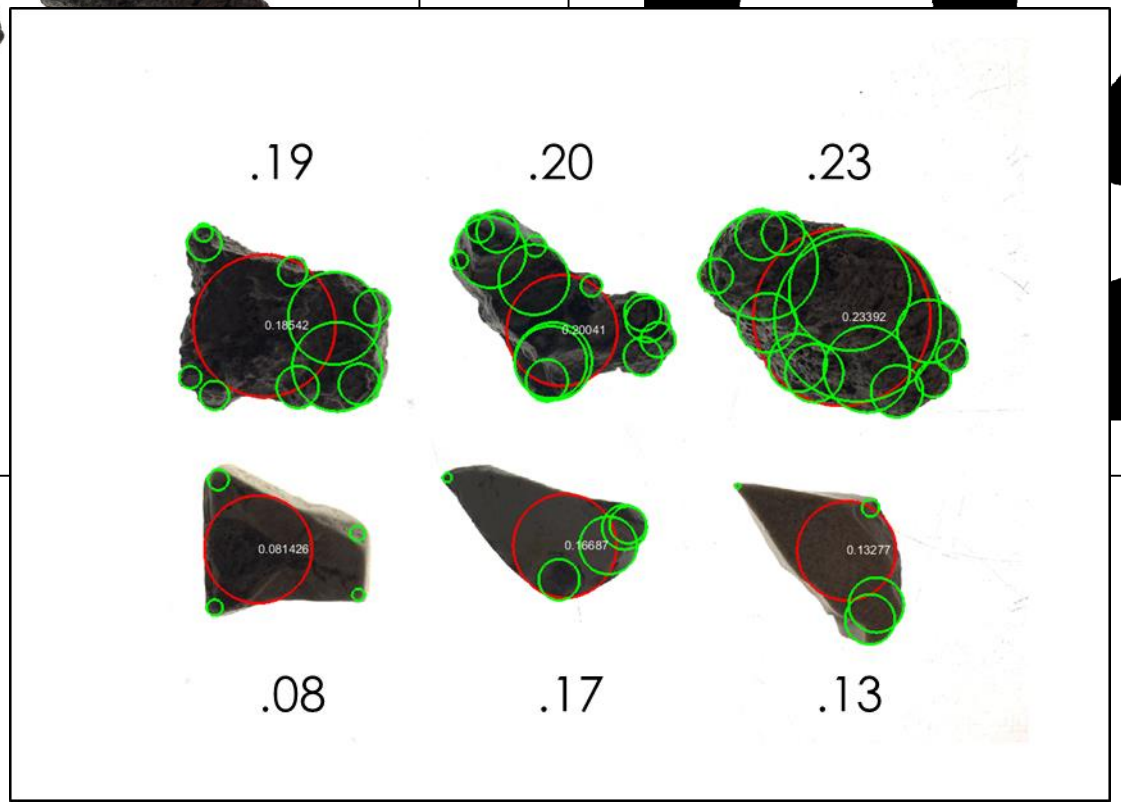
- Partikelgröße
- Form





Keramik - Algorithmische Geometrie*





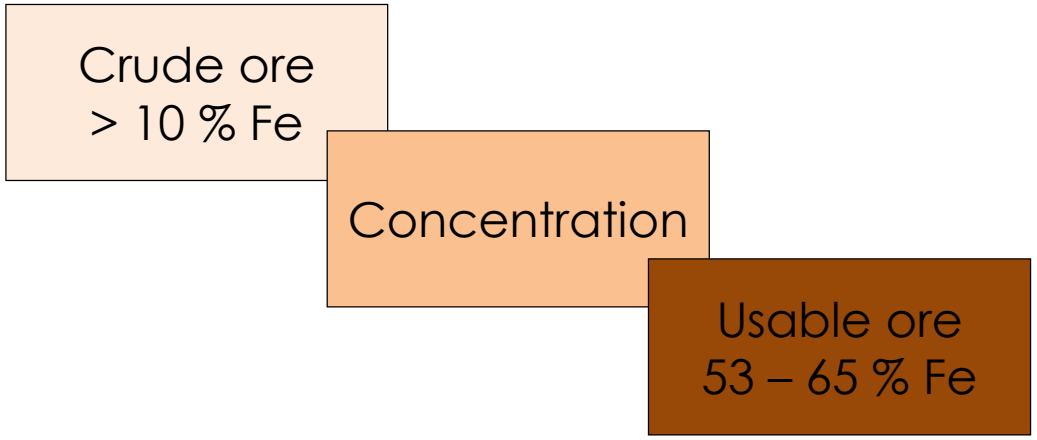
Sortierung möglich?

- *Wadell Rundheit [4]
- erkannten Ecken

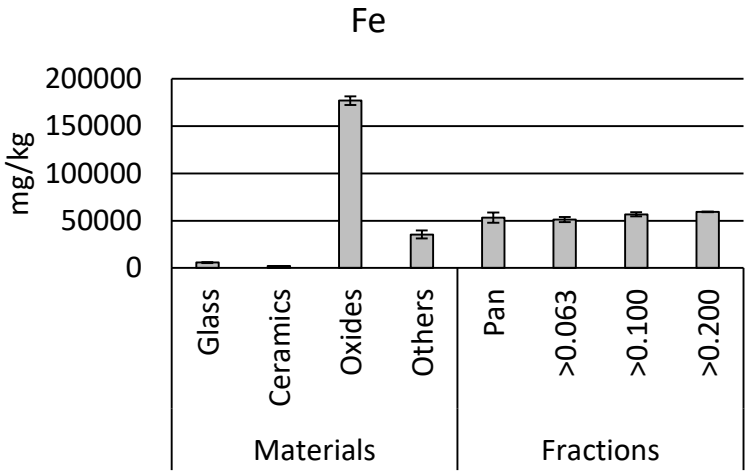
Magnetische Partikel – Eisenoxide

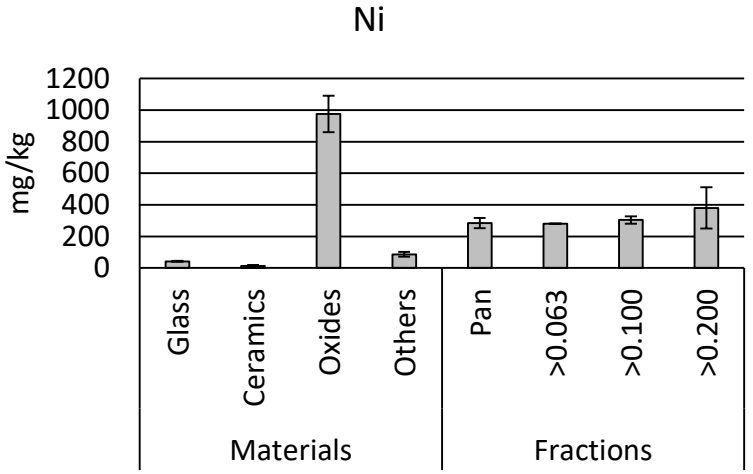
Chemische Zusammensetzung nach Königswasseraufschluss

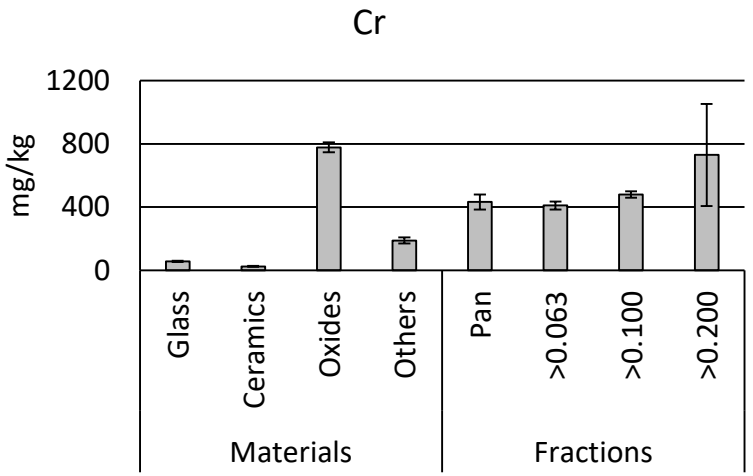
- Fe 18 % → minderwertiges Eisenerz [5]
- Anreicherung von Ni, Cr, Co, Li
- Roherz: 10 – 60 % Fe (Australien, Brasilien)
- China: 10 – 35 % Fe

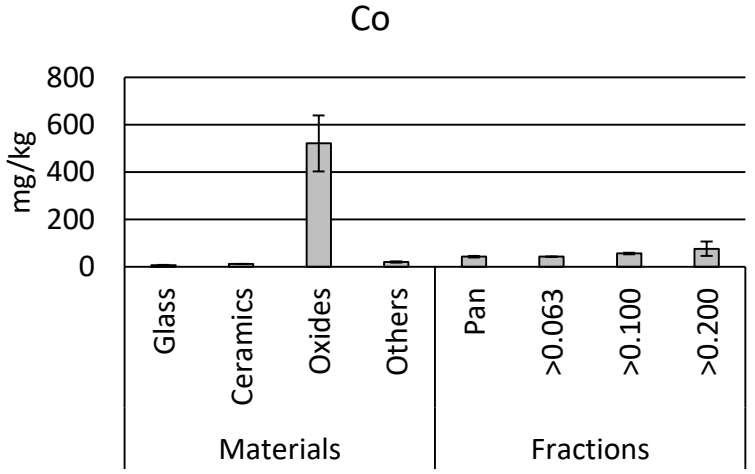


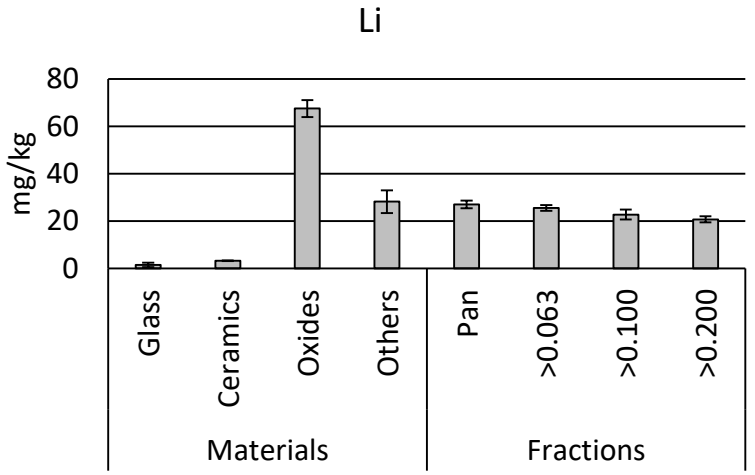
Magnetische Partikel – Eisenoxide











Schlussfolgerungen und zukünftige Arbeit

Feinfraktion (23 – 30 %)

- starke Kontamination
- Metallverwertung (nicht immer angewandt)

Übriger Anteil (≈ 35 %)

- Straßenbau, Deponiebau, Lärmschutzwände
  - Salze und andere Elemente (Sb, Cr, Cu, Mo, V)
- Trocken Aufbereitung (Abrieb, im Gange)
  - Perkolationsversuch (W/F-Verhältnis = 2 l/kg)
    - Chloride, El. Leitfähigkeit: - 26 %
    - Sulfate, TOC: - 39 %

Referenzen

[1] https://ec.europa.eu/eurostat/cache/metadata/en/env_wasmun_esms.htm

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0098&from=EN

[3] European Commission (2018): BREF on Waste Incineration - Final draft. BREF WI. URL: http://eippcb.jrc.ec.europa.eu/reference/BREF/WI/WI_BREF_FD_Black_Watermark.pdf

[4] Zheng, Junxing & Hryciw, Roman. (2016). Roundness and Sphericity of Soil Particles in Assemblies by Computational Geometry. Journal of Computing in Civil Engineering. 30. 10.1061/(ASCE)CP.1943-5487.0000578.

[5] Global Iron Ore Production Data; Clarification of Reporting from the USGS Mining engineering February, 2017 (reprinted with permission)

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