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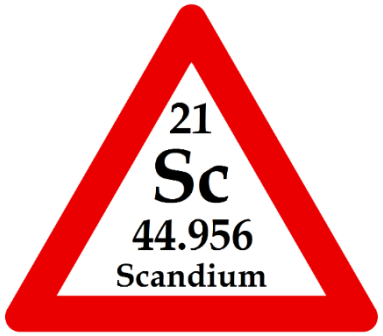

RWTH AACHEN UNIVERSITY

Innovative Scandium Refining Process from Secondary Raw Materials

Bengi Yagmurlu, Carsten Dittrich

Introduction – MEAB Chemie Technik GmbH

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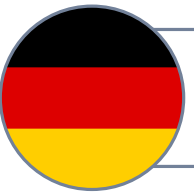
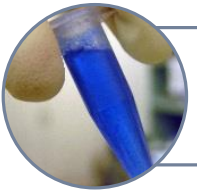
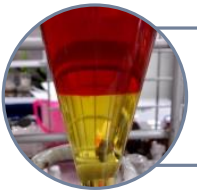


Founded in 1970

Located in Aachen/Germany, near 3 borders



Active in hydrometallurgical field

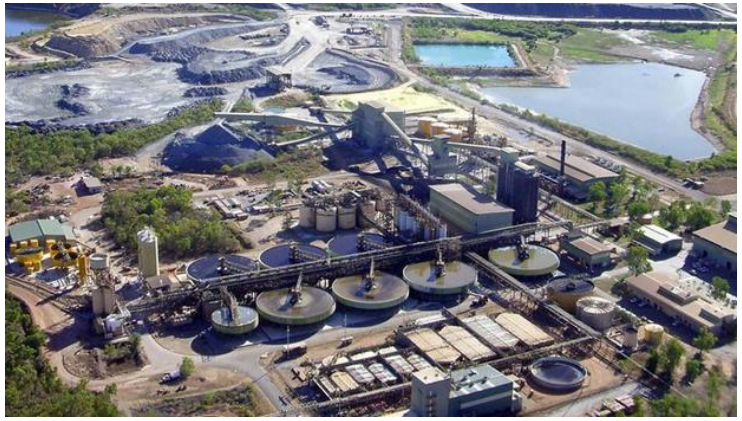


Special interest : Solvent Extraction

Active role on research: SCALE, REDMUD, EURARE, etc.

Introduction – Scandium Sources

- Mainly produced as a **by-product**
  - Ni laterites
  - TiO_2 pigment
  - Uranium extraction
  - Bayer Process



Example Case: Bauxite Residue

Stockpiled all over the world

Currently 4 billion tonnes and growing

Varying compositions of Sc

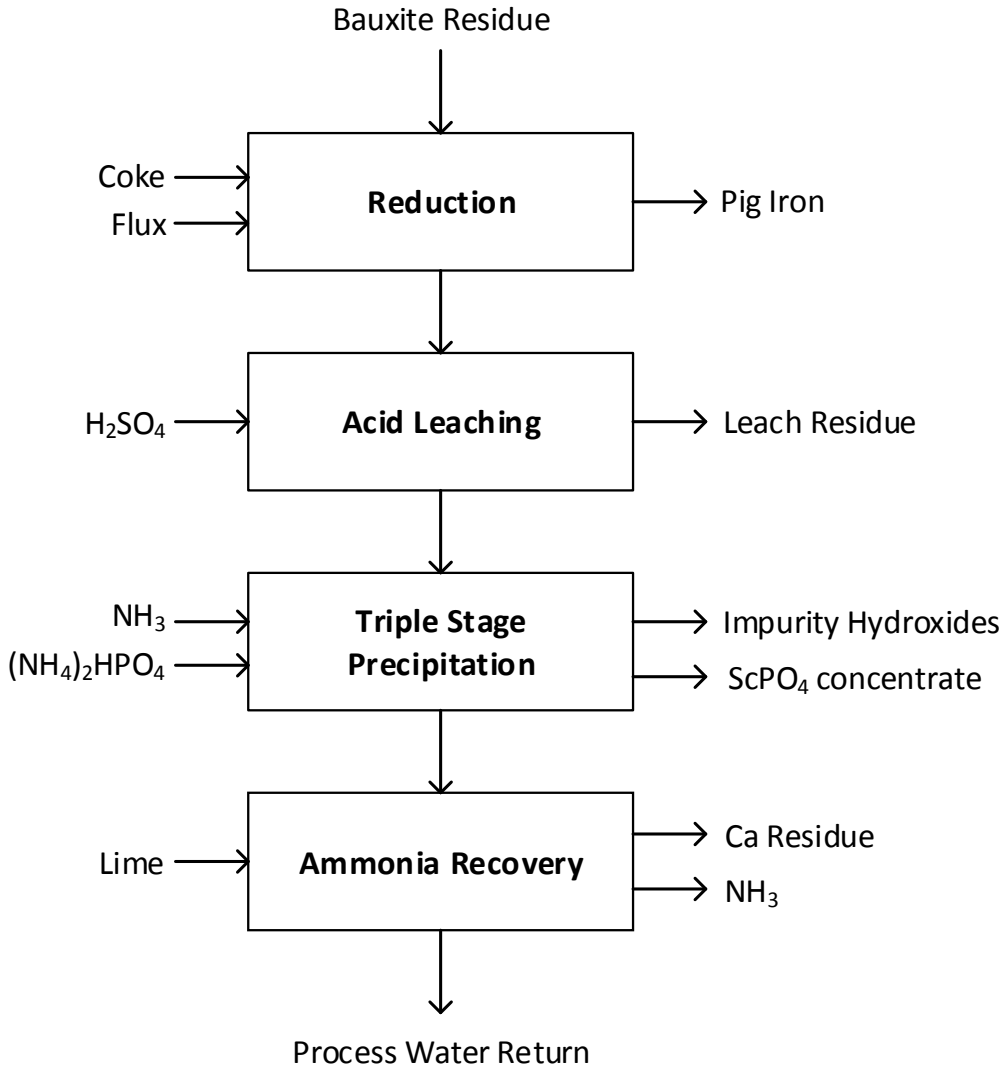
Promising resource

<u>In this case:</u>

Greek Bauxite Residue

Contains 120ppm Sc

Example Case: Bauxite Residue



Why Slag Making?

- Removal of major part of bauxite residue
- Concentrating Sc in slag
- Control of phases and crystallinity
- Easier leaching

Innovative Leaching Method

- Si-gel problem
- Addition of H_2O_2
- Oxidative Leaching Conditions
- >95% Leaching efficiency for Sc

Example Case: Bauxite Residue

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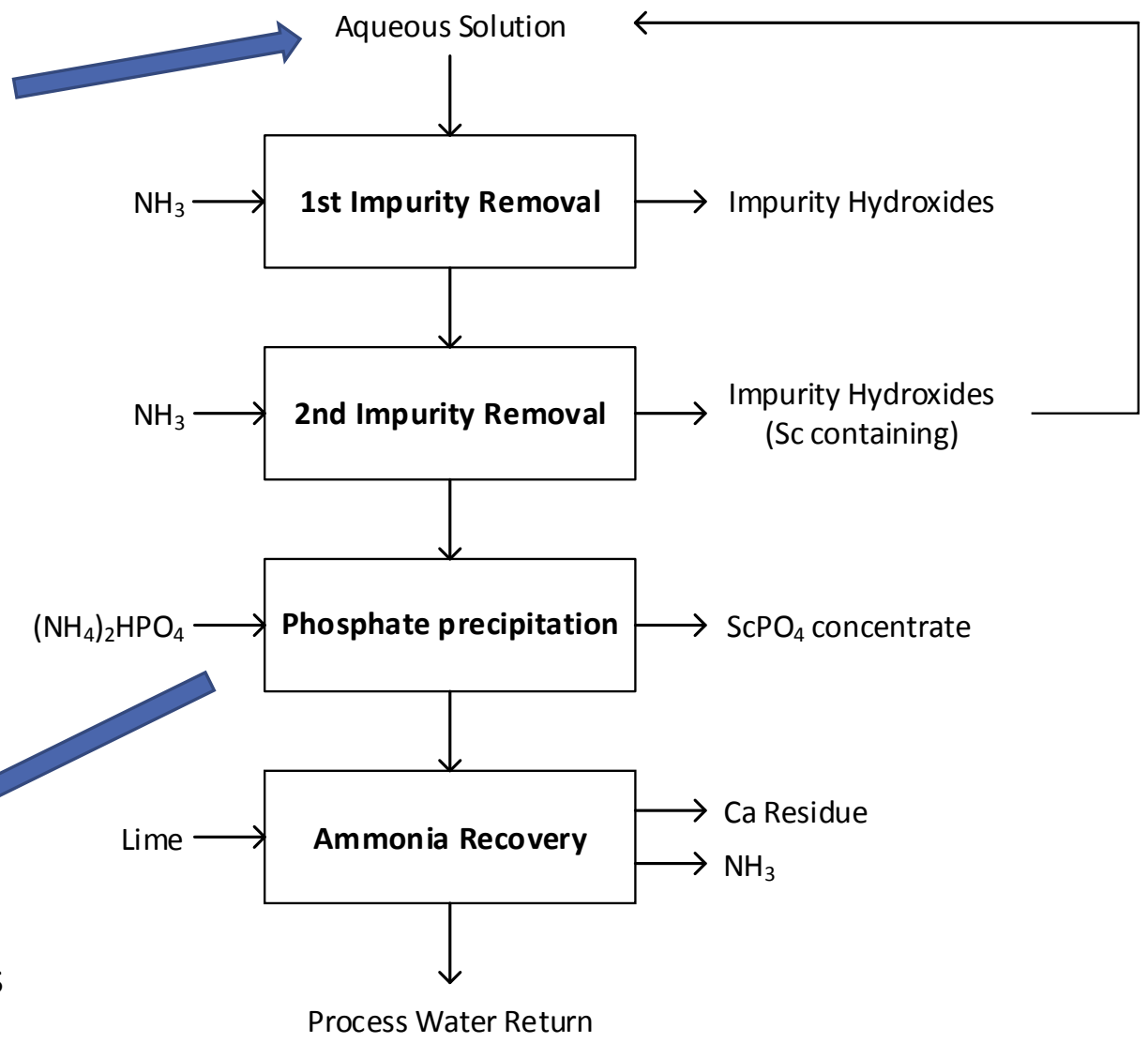
Major Elements	g/L	Minor Elements	mg/L
Al	18.6	**Sc**	16
Fe	1.7	**Ce**	16
Ti	3.1	**Y**	6
Ca	0.6	**La**	4
Si	0.3	**Th**	11



- High impurity removal rate
- Selective Sc precipitation
- Easy dissolution of Sc concentrate
- Easy further processing for further purification operations

Example Case: Bauxite Residue

MEAB

Extraction

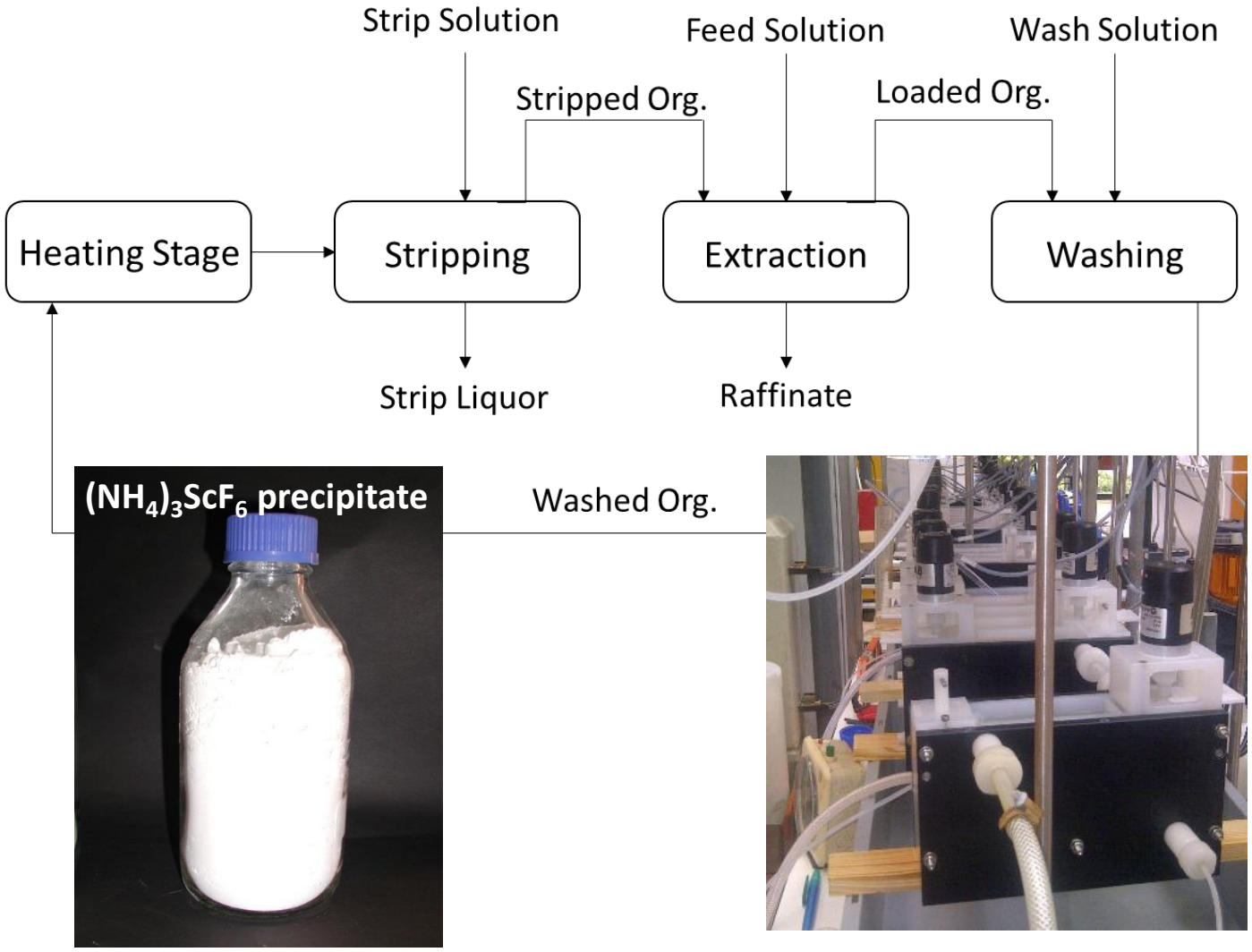
- High Sc Selectivity
- Low co-extraction

Washing

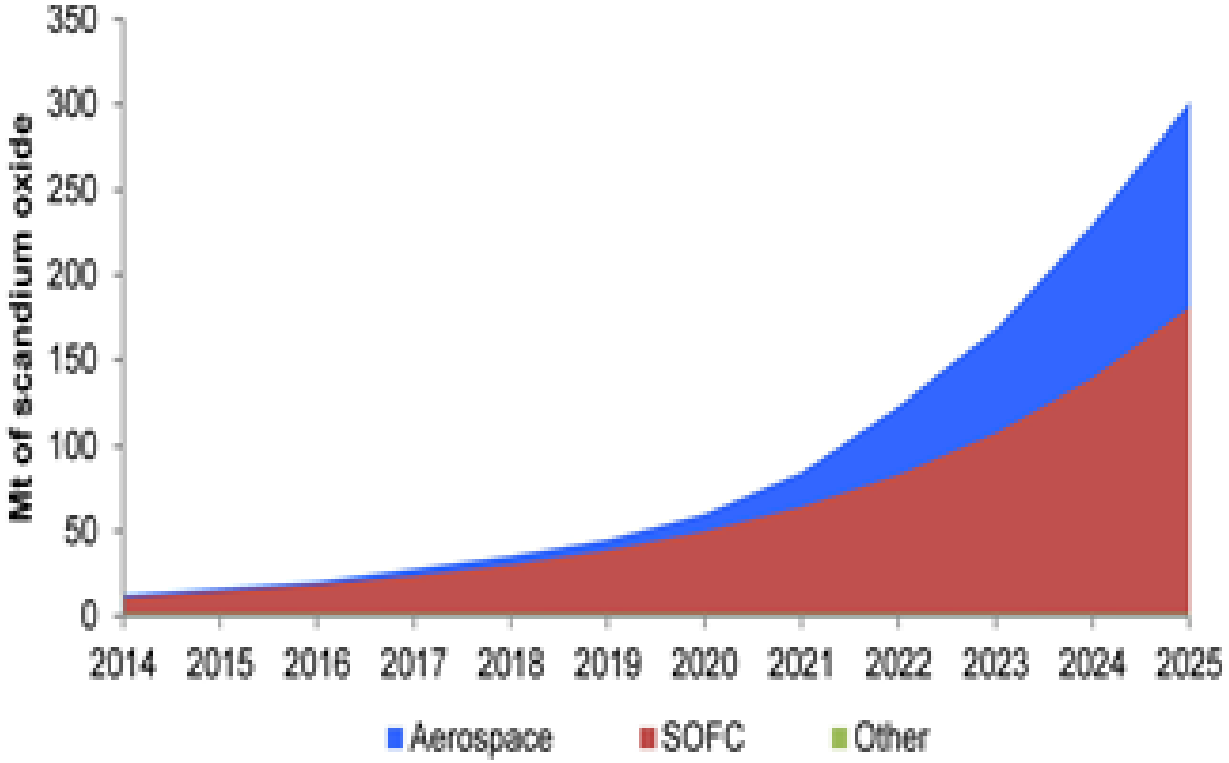
- Avoiding HF formation

Stripping

- Using NH4F
- Low impurity level
- Purification during precipitation
- Re-use of strip solution after precipitation

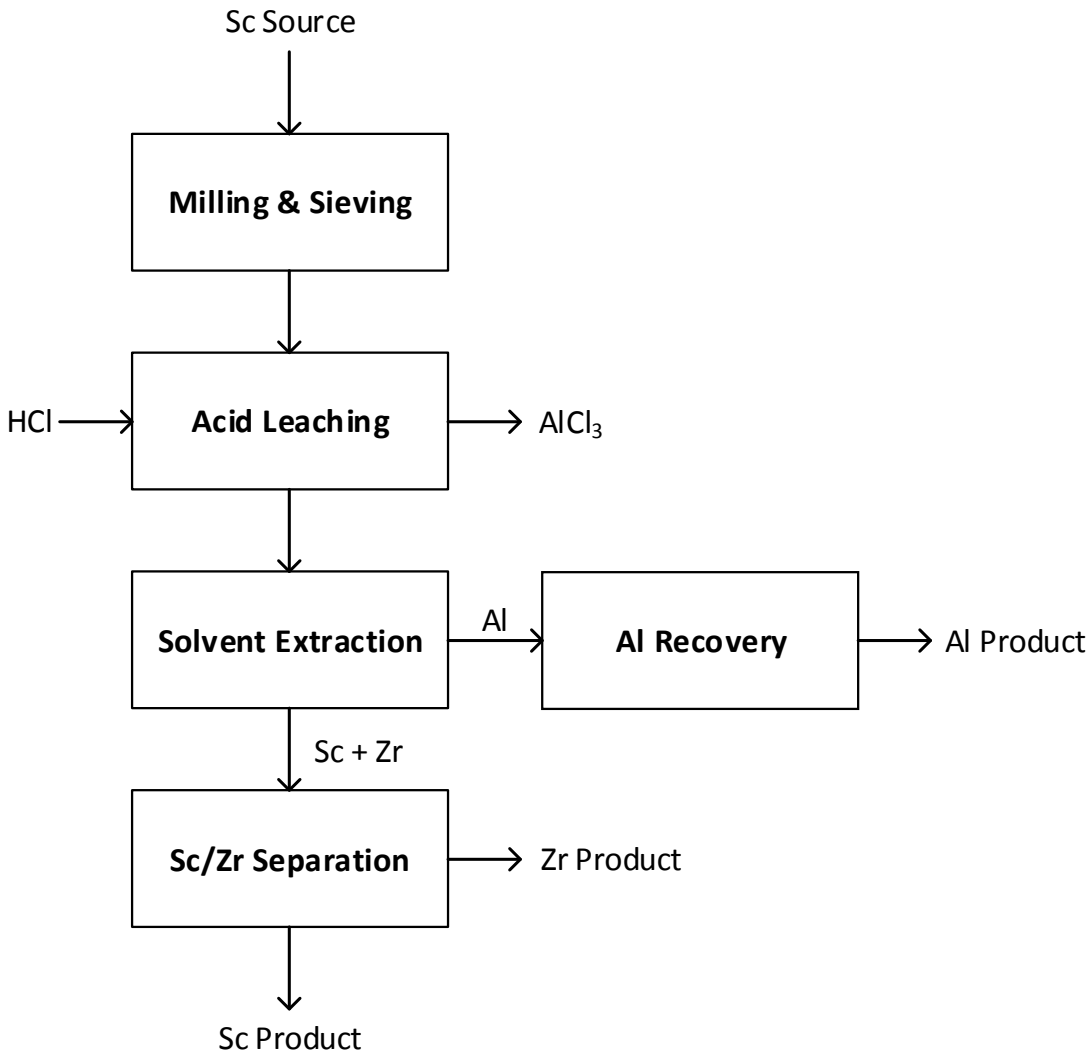


Significant Resource – Recovery from Alloys



- Expected increase in Sc usage
- Most important secondary resource of Sc
- Concentrated and already in metalic or oxide form
- Easy dissolution and processing
- Major impurities: Al, Zr, Mg, Mn
- Individual separation of each element

Significant Resource – Recovery from Alloys



- Fine Al-Sc Alloy powder (metallic)
  - Fast exothermic reaction
  - >99% dissolution of all metals
- Master alloy drosses (oxide)
  - Concentrated Sc in small particles
  - >95% leaching efficiency
  - Slow reaction due to stable oxides

Conclusions

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- **High focus of EU on Scandium production**
  - Unreliable source and increase in demand
  - Active role in 3 Sc-related projects
- **Bauxite residue is a promising resource**
  - Huge stockpiled amount
  - Development of an effective process
  - Scale-up plans backed by EU H2020 RemovAL Project
- **Best resource for future need will be Sc containing products**
  - Recovery directly from Al-Sc alloys and SOFC
  - Highly efficient and feasible process
  - Flexible Sc product

scale
SCANDIUM ALUMINIUM EUROPE

removAL
removing waste from alumina production