ERA-MIN 2

RESEARCH & INNOVATION PROGRAMME
ON RAW MATERIALS
TO FOSTER CIRCULAR ECONOMY

BASH-Treat

Optimization of bottom ash treatment for an improved recovery of valuable fractions

Coordinator: Prof. Dr. Ing. Kerstin Kuchta -Hamburg University ofTechnology (DE)
Presenter: M. Sc. Marco Abis – Hamburg University of Technology (DE)

ERA-MIN 2 Final Conference and Final Seminar of Call 2017 projects
18-19th November 2021

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Consortium

- Topic: **3. Processing, Production and Remanufacturing**
  - 3.1 Increase resource efficiency in resource intensive production processes
  - 3.2 Increase resource efficiency through recycling of residues or remanufacturing
  - 5.2 Improvement of methods or data for environmental impact assessment
- Timeframe: 01.05.2018 – ~~30.04.2021~~, ~~30.10.2021,~~ **30.04.2022** (~~36~~ ~~42~~ **48** M)
- **Consortium:**
  - **TUHH** Hamburg University of Technology, University **(DE)** **[BMBF]**
  - **PoliTo** Polytechnic University of Turin, University **(IT)** **[MIUR]**
  - **Heidemann Recycling GmbH**, Small-Medium Enterprise (**DE**)
  - **BAM** Fed. Inst. for Materials Research and Testing, Fed. Inst. **(DE)** **[BMBF]**
  - **Sysav R&D** Sysav South Scania Waste, Large Enterprise **(SE)**
- **Start – end TRL: 2 - 7**
- **Project budget**
  - Total: 506.600 €, Requested funding: 451.600 €, circa 80-85 % executed

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Final Results – Objectives

- Project **objectives and expect impacts** vs **final results and impact**
  - **OBJ-1: Evaluation of MSWI Bottom Ash (BA) treatment perspectives**
    - **Relevant gap** among European countries adopted treatments (consolidated incineration experience → high standards for bottom ash treatment) [1, 3]
    - Focus on **coarse fraction** for metal recovery, **scattered reuse cases** for mineral fraction (**downcycling** or **backfilling**), **few fine fractions treatments** [1, 3]
    - Besides metals**, lack of material recycling** consolidated practices (e.g. glass, ceramics, iron oxides)
  - **OBJ-2**: Holistic resource & raw material **recovery/quality improvement**
    - **Coarse fraction**: development of mineral fraction dry abrasion treatment **(TRL 4-5)** (selective removal of PTEs, enabler for advanced treatments (e.g. optical separators)) [2]
    - **Fine fraction**: advanced treatment for fine fraction (combination of latest dry treatment technologies **(TRL 7)** + wet density separation **(TRL 4-5)** [4])
    - Overall environmental and economical analysis of the treatment train
  - **OBJ-3**: Contribute to the development of end-of-waste criteria for bottom ash
    - In progress

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Final Results – Outputs

- **Outputs (Publications)**
  - [1] Abis, M.; Bruno, M.; Kuchta, K.; Simon, F.-G.; Grönholm, R.; Hoppe, M.; Fiore, S. **Assessment of the Synergy between Recycling and Thermal Treatments**. Municipal Solid Waste Management in Europe. Energies 2020, 13, 6412 (https://doi.org/10.3390/en13236412)
  - [2] Abis, M.; Bruno, M.; Simon, F.-G.; Grönholm, R.; Hoppe, M.; Kuchta, K.; Fiore, S. **A Novel Dry Treatment for Municipal Solid Waste Incineration Bottom Ash for the Reduction of Salts and Potential Toxic Elements**. Materials 2021, 14, 3133 (https://doi.org/10.3390/ma14113133)
  - [3] Bruno, M.; Abis, M.; Kuchta, K.; Simon, F.-G.; Grönholm, R.; Hoppe, M.; Fiore, S. **Material flow, economic and environmental assessment of municipal solid waste incineration bottom ash recycling potential in Europe**. Journal of Cleaner Production 2021, 317, 128511 (https://doi.org/10.1016/j.jclepro.2021.128511)
  - [4] Pienkoß, F.; Abis, M.; Bruno, M.; Grönholm, R.; Hoppe, M.; Kuchta, K.; Fiore, S; Simon, F.-G. **Heavy metal recovery from the fine fraction of solid waste incineration bottom ash by wet density separation**. Journal of Material Cycles and Waste Management (accepted, in press) (https://doi.org/10.1007/s10163-021-01325-1)

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Final Results – Outputs

- **Outputs (Conferences)**
  - **Sardinia Symposium 2019**: The 17th International Waste Management and Landfill Symposium (30 September – 04 October 2019). Santa Margherita di Pula, Italy
  - **SUM 2020**: 5th Symposium on Urban Mining and Circular Economy (08 – 20 November 2020). **Online event**, Italy
  - **CRETE 2021**: 7th International Conference on Industrial and Hazardous Waste Management (27 – 30 July, 2021). **Hybrid event**, Crete, Greece
  - **17. VGB Workshop** "Products from thermal waste treatment" (in German) (12.11.2018 – 13.11.2018) Magdeburg, Germany
  - **Annual meeting of the ProcessNet specialist groups** Waste Treatment and Materials Recovery, Energy Process Engineering, Gas Cleaning, High Temperature Technology, Raw Materials (planned for 2022)
- **Communication and dissemination activities**
  - Scientific divulgation / Journal and conference articles / Academia & industry (open access publications)
  - Spring School @TUHH (~~2021~~ – postponed to 2022) / Academia & Students
  - Scientific article: Economical and environmental assessment of the proposed measures (planned for 2022)
  - Final project meeting & presentation/ Mixed audience (planned for 2022)

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Impact

- Lessons learnt (i.e. impact of COVID-19)
  - Major difficulties linked to delays (transboundary testing activities, bureaucratic barriers)
  - Positive for scientific outputs (paper) → Plan some project stop-and-go periods for publishing?
- Have you cooperated with policymakers during the lifetime of the project?
  - Not really / not yet
- Have the results been implemented by the industry to some extent?
  - Coarse fraction: still some economical knots to be solved before application (market value of recovered materials, deviated masses from landfilling)
  - Fine fraction: partial implementation of the proposed treatment trains
- Have the results contributed to white papers, regulations or standards?
  - No / not aware

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Impact – SIP & EIP

- **Contribution to ERA-MIN Research Agenda and the Strategic Implementation Plan of the EIP on Raw Materials**
- Refinement of coarse BA fraction with positive effects on: purity of recovered metals (Fe, AL, Cu), and potentially recoverable fractions (e.g. glass, ceramics)
  - Action area n° I.4**: Processing and refining of raw materials**
  - Action area n° I.5**: Recycling of raw materials from products, buildings and infrastructure**
  - Action area n° II.5**: Optimised waste flows for increased recycling**
- Proposed treatment train for the enhancement of the NFe base metal recovery from fine BA
  - Action area n° I.4: **Processing and refining of raw materials**
  - Action area n° I.5: **Recycling of raw materials from products, buildings and infrastructure**
- Evaluation of MSWI Bottom Ash (BA) treatment practices and perspectives
  - Action area n° I.4**: Processing and refining of raw materials**
  - Action area n° II.8: **European Union Raw Materials Knowledge Base**

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Follow-up

- How will the research results of the project be utilised?
  - Surface treatment potentially applicable to other mineral residues
  - Basis for other research project (open questions)
  - Optimization of the process
- Will the cooperation continue after the end of this project?
  - Supervision of a Ph.D. project from BAM at TUHH on hazardous properties of bottom ash
  - Further project in progress

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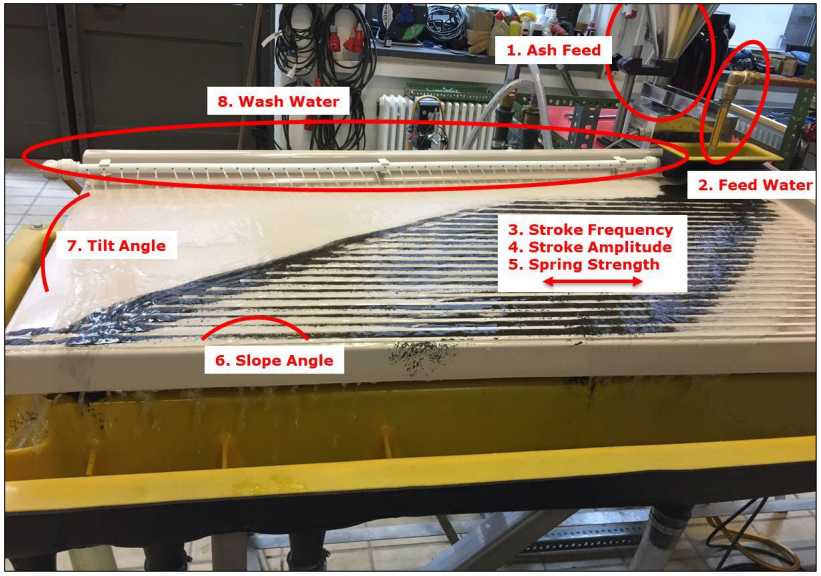
Pictures



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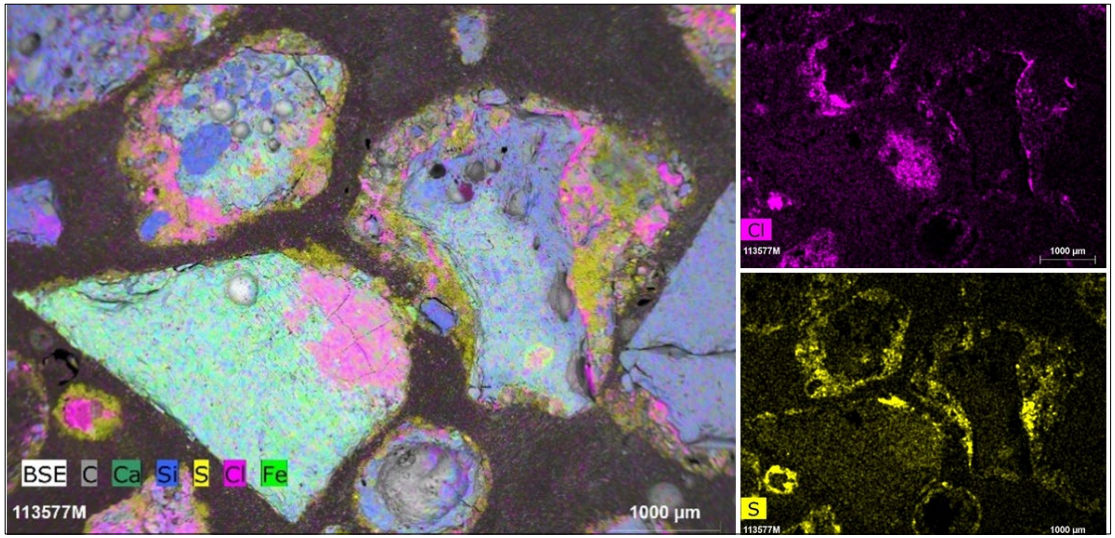
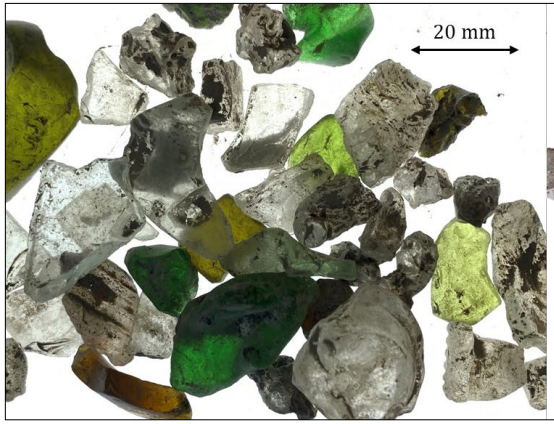
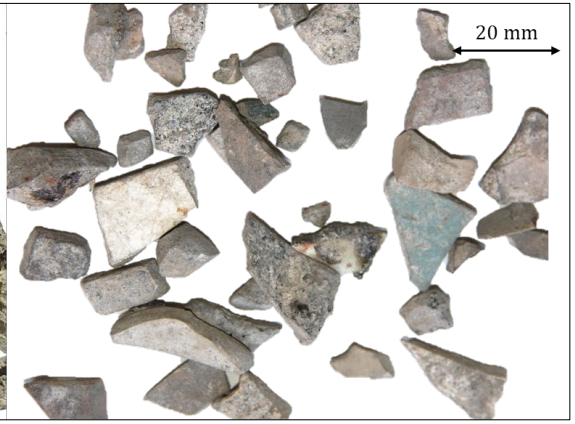
Pictures







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POLITECNICO DI TORINO

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HEIDEMANN
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SYSAV

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