Foundry Dust Recycling in Pilot Plant and Application – Resource Conservation, Substitution and Digitalization Towards 100% Efficiency

(Gießereistaubrecycling in Technikum und Anwendung – Ressourcenschutz, Substitution und Digitalisierung Richtung 100% Effizienz)

Recy & DepoTech 2024

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ForCYCLE T

Projektverbund Technikum

Background

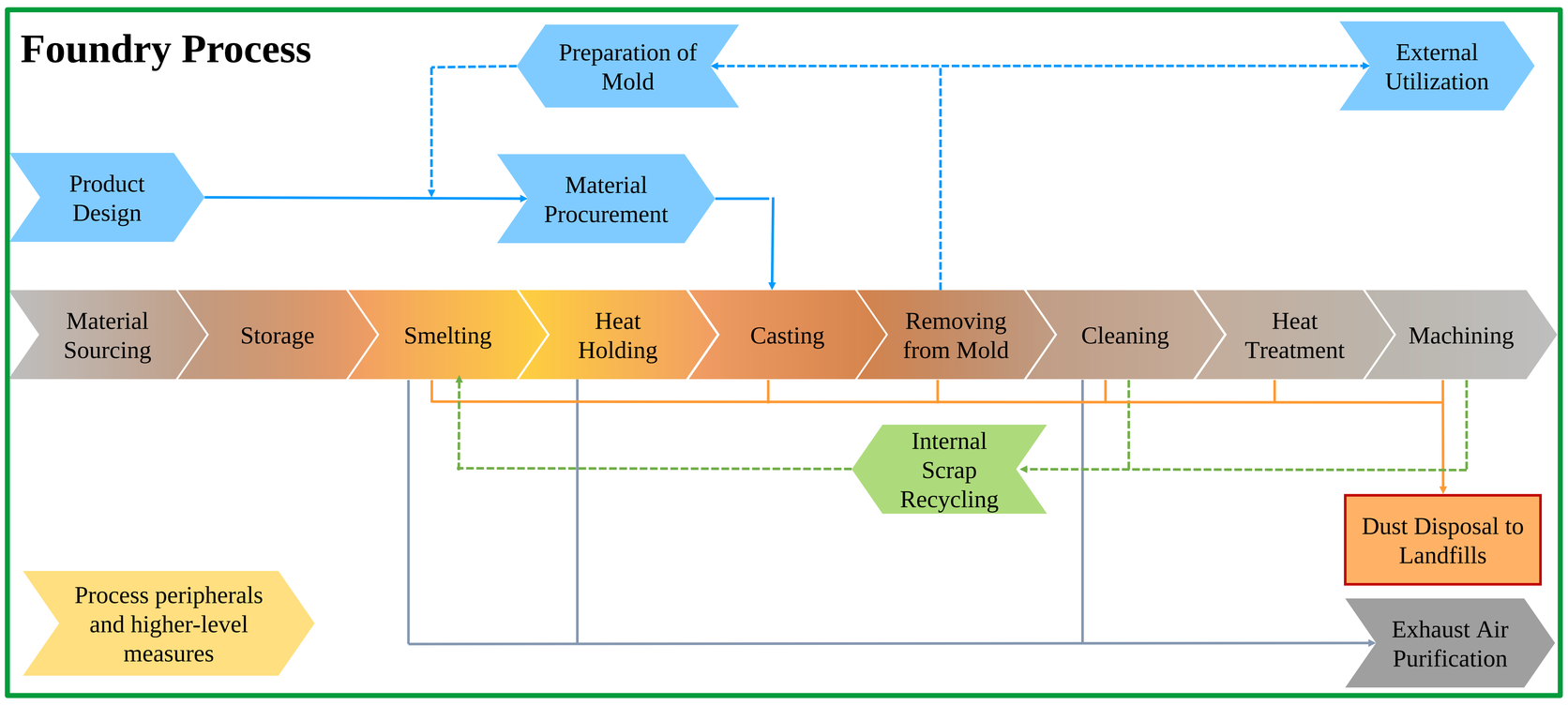
- Bavarian foundries dispose of several thousand tons of foundry dust in landfill annually.
- Each casting stage produces specific types of foundry dust.
- Disposal leads to increased landfill, operational, and material costs.
- Chemical analysis shows high levels of recyclable Fe and Si in the dust.
- ForCYCLE II found that foundry dust can be recycled by mixing it with SiC briquettes.

Project Objectives

- Recycling of foundry dusts via SiC briquettes.
- Transfer of digital data of dust and material flow from the ForCYCLE II project to ForCYCLE Technikum.
- Optimize and finalize SiC briquette recipes with defined ingredients in accordance with the requirements of the foundries.
- Use of sustainable binders instead of Portland cement to reduce carbon footprint, such as ground granulated blast furnace slag, ground granulated electric arc furnace slag, or Cupola furnace slag.
- Digitalization of the process and optimized implementation of dust recycling procedure.

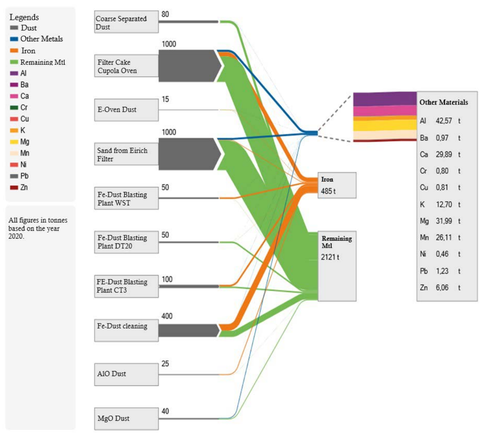
Project Achievements

- Adequate strength for SiC briquettes has been confirmed through testing by a briquette manufacturer, and the recipe is currently undergoing final optimization for completion.
- Partial substitution of cement with cupola furnace slag and recycled dust has been identified as a viable strategy for reducing CO_2 emissions.

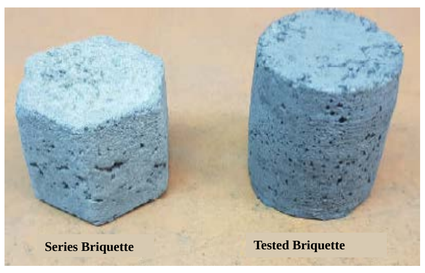


Methodology

Collection of foundry dust from different sources

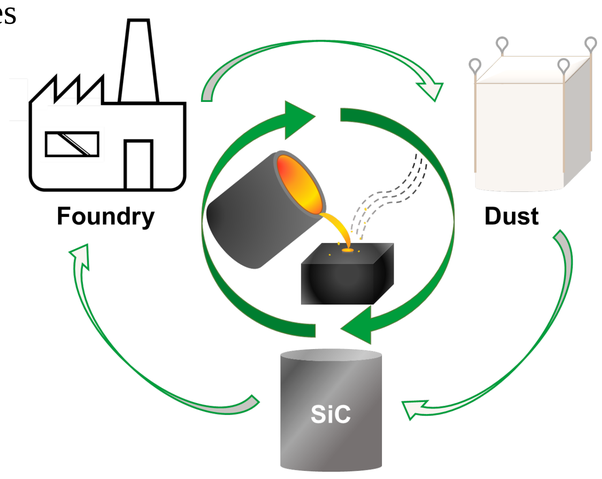


Analyzed and Digitized Dust Data

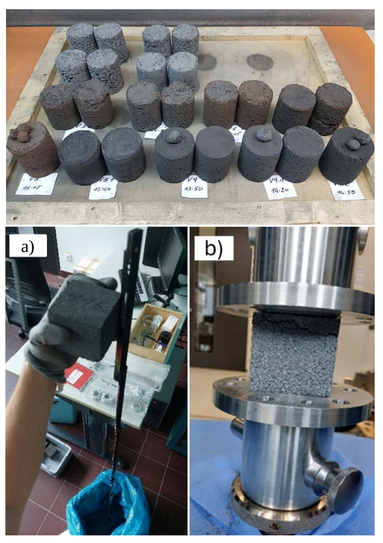


Research on recipes for briquettes

Casting being done in the foundry



Production and storage of briquettes for foundry usage

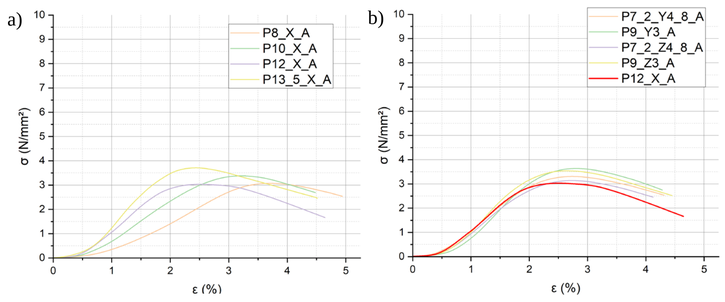


Laboratory material testing and optimization

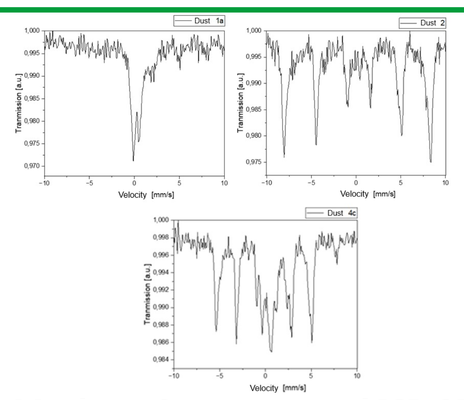
Results

Cement Reduction	σ48h [N/mm²]	SD [N/mm²]
P8_X_A	3.05	0.11
P10_X_A	3.45	0.16
P12_X_A	3.42	0.32
P13_5_X_A	3.77	0.22

Cement Substitution	σ48h [N/mm²]	SD [N/mm²]
P7_2_Y4_8_A	3.36	0.12
P9_Y3_A	3.69	0.47
P7_2_Z4_8_A	3.17	0.10
P9_Z3_A	3.75	0.32
P12_X_A	3.42	0.32



Briquette strength after 48 hr with a) only reducing Portland cement quantity; and b) with Cupola Furnace or Ground Granulated electric arc furnace slag inclusions.



	Foundry 1			Foundry 2			
	Dust 1a	Dust 2	Dust 4c	Furnace Dust [m%]	BMD 1	BMD 2	BMD 3
Al	0,47	0,47	1,78	0,34	0,25	1,69	0,17
Ba	0,08	0,01	0,04	0,01	0,02	0,05	0,01
Ca	1,46	0,44	0,60	0,24	10,09	1,26	0,48
Cr	0,04	0,04	0,09	0,04	0,02	0,04	0,01
Cu	0,10	0,10	0,07	0,18	0,02	0,11	<0,01
Fe	21,80	39,80	20,50	0,12	0,72	3,02	0,74
K	0,09	0,09	0,09	0,02	0,02	2,44	0,03
Mg	1,90	1,91	0,50	1,02	0,36	0,66	0,03
Mn	3,99	4,00	0,53	0,12	0,01	<0,01	0,04
Mo	0,01	0,01	0,01	<0,01	<0,01	<0,01	<0,01
Na	0,29	0,30	0,40	0,01	0,12	<0,01	0,04
Ni	0,03	0,03	0,04	0,01	0,01	<0,01	<0,01
Pb	0,06	0,06	<0,01	0,05	<0,01	4,17	0,01
S	0,79	0,79	0,10	0,46	0,44	0,40	0,04
Sb	0,01	0,01	0,01	0,03	<0,01	0,04	<0,01
Si	8,43	3,73	12,00	1,95	14,5	19,4	8,83
Ti	0,03	0,03	0,06	0,10	0,04	<0,01	<0,01
Zn	0,42	0,42	0,01	<0,01	<0,01	2,39	0,12

Mössbauer Spectroscopy and ICP-OES of different dust samples was done for foundries of two different foundries and the resulting table of composition.

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