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Fines2EAF – Trials at Marienhütte

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Christoph Sorger

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Marienhütte

Overview

- Input material
- Procedure
- Results
- Summary & Conclusion



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Input material

	MH LFS	HRS MAU
FeO [%]	2	10
CaO [%]	46	38
SiO ₂ [%]	27	15
MgO [%]	13	12
Al ₂ O ₃ [%]	8	14



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Input material

Recipe	MH LFS [%]	MAU HRS [%]	starch [%]	fibers [%]	water [%]
M 31 R / 6 (wheat starch)	88.6	0	5.3	0.9	5.3
M 31 R / 4 (wheat starch)	91.7	0	3.7	0.9	3.7
MH 52 / B (potato starch)	69.3	20.8	3.6	0.9	5.4
MH 52 B / 4 (potato starch)	46.4	46.2	3.6	0.9	2.9

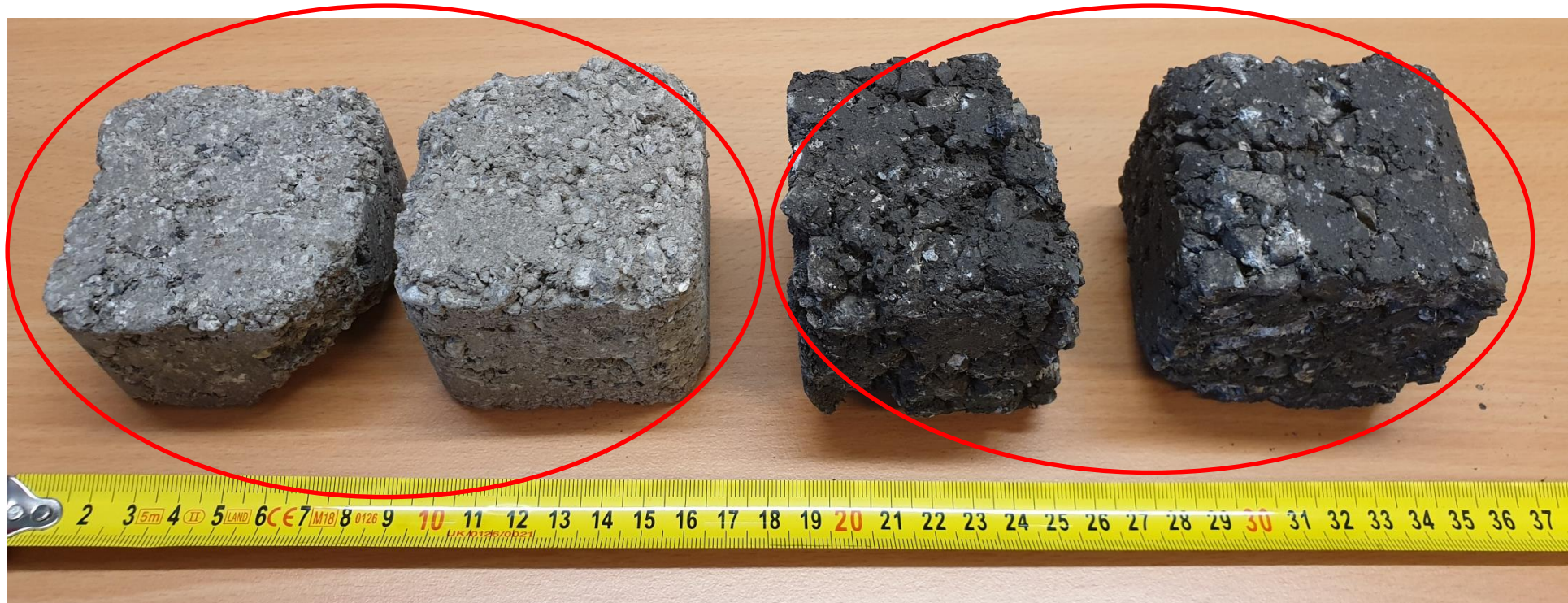


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Briquettes

MH 31 R (wheat starch)

MH 52 B (potato starch)



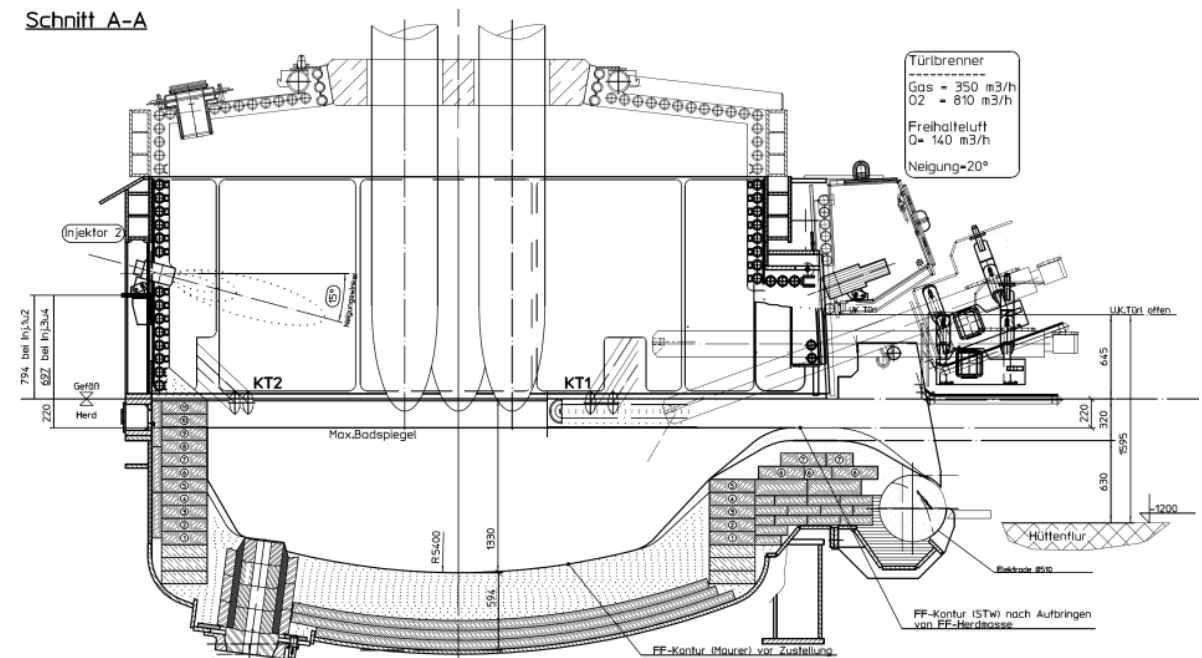


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Procedure

- Usual process
 - 42 min. Tap-to-tap time
 - 30 min. melting time
 - 40 t crude steel
 - 7 t slag
 - Setting of 3 baskets of scrap
 - 450 kg lime + 300 kg dolo lime before first basket
 - 450 kg lime before second basket

→ Replacement of slag formers





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Procedure

- Trials with wheat starch
 - Input via chute before 2. basket

Trials	Amount of briquettes	Used slag formers
Additional charge	500 kg	+ 900 kg lime, + 300 kg dolomitic lime
Replacement of dolomitic lime	1000 kg	+ 900 kg lime
Partial replacement of lime	500 kg	+ 700 kg lime, + 300 kg dolomitic lime
Partial replacement of lime and dolomitic lime	500 kg	+ 800 kg lime, + 250 kg dolomitic lime



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Procedure

- Trials with potato starch
 - Input in 1. basket

Trials	Amount of briquettes	Used slag formers
Partial replacement of lime	500 kg	+ 700 kg lime, + 300 kg dolomitic lime
Partial replacement of lime and dolomitic lime	500 kg	+ 800 kg lime, + 250 kg dolomitic lime
Replacement of dolomitic lime	500 kg	+ 900 kg lime
Replacement of dolomitic lime	1000 kg	+ 900 kg lime



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BigBags with briquettes





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Transportation of the BigBags to the chute





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Briquettes in chute





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Charging of Big Bags via basket





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Generated slag





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Results

- **Trials with wheat starch**

- Analysed by XRF

Briquettes Amount of Briquettes Type of adding	MH 31 R / 6 500 kg additional	MH 31 R / 6 1000 kg replacement dolo lime	MH 31 R / 4 500 kg Partly repl. of lime (+700 kg CaO)	MH 31 R / 4 500 kg Partly repl. of lime + dolo lime (+800 kg CaO and + 250 kg dolo lime)	Reference 900 kg CaO + 300 kg dolo lime
SiO ₂ [%]	17.98	17.25	12.46	16.54	13.11
Al ₂ O ₃ [%]	12.81	15.05	13.39	12.16	13.44
Fe ₂ O ₃ [%]	36.24	34.64	47.05	37.69	41.4
Mn ₃ O ₄ [%]	4.55	4.71	4.82	4.92	5.16
MgO [%]	5.39	5.41	5.76	5.68	5.87
CaO [%]	23.55	24.16	20.45	22.78	21.11
P ₂ O ₅ [%]	0.3	0.29	0.3	0.3	0.35
Basicity	1.31	1.40	1.64	1.38	1.61
Additional CaO [kg]	1230	1263	1047	1113	1026
Additional MgO [kg]	199	142	195	179	141
Additional SiO₂ [kg]	120	239	124	124	0



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Results

- Trials with potato starch

- Analysed by XRF

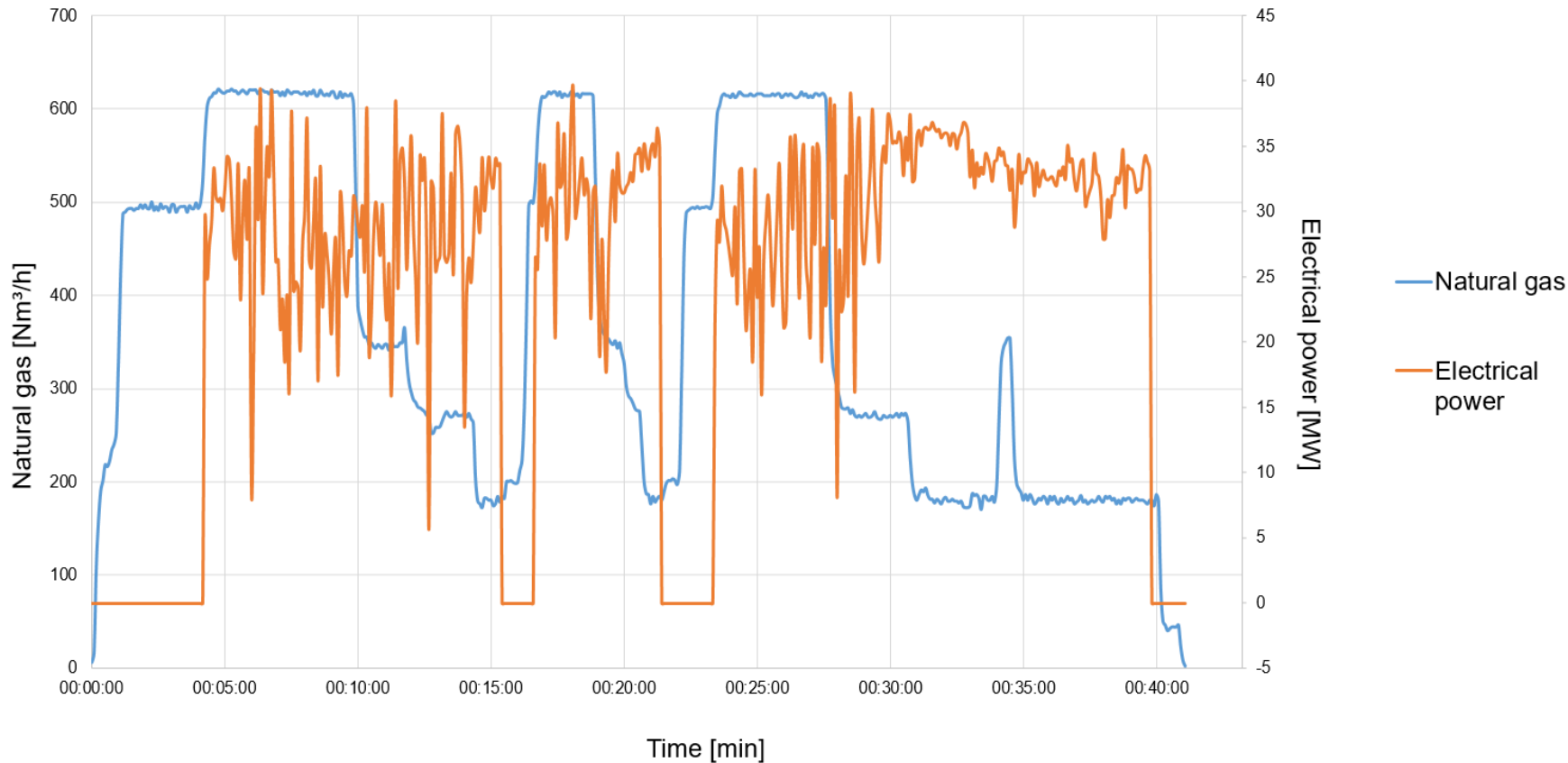
Briquettes	MH 52 B / 4	MH 52 B	MH 52 B	MH 52 B	MH 52 B	MH 52 B	MH 52 B
Amount of Briquettes	500 kg	500 kg	500 kg	1000 kg	500 kg	500 kg	1000 kg
Type of adding	Partly repl. of lime (+700 kg CaO)	Partly repl. of lime + dolo lime (+800 kg CaO and + 250 kg dolo lime)	Partly repl. of lime + dolo lime (+800 kg CaO and + 250 kg dolo lime)	replacement dolo lime	replacement dolo lime	replacement dolo lime	replacement dolo lime
SiO ₂ [%]	16.36	12.45	13.8	13.91	14.05	16.69	15.93
Al ₂ O ₃ [%]	13.01	9.04	10.35	14.22	14.17	13.04	13.32
Fe ₂ O ₃ [%]	37.91	45.95	42.65	38.58	37.89	36.47	41.17
Mn ₃ O ₄ [%]	4.96	5.32	5.5	4.9	5.09	5.65	4.92
MgO [%]	5.21	7.74	7.24	5.67	6.03	6.09	5.53
CaO [%]	24.59	22.6	23.81	25.58	25.64	24.98	23.42
P ₂ O ₅ [%]	0.56	0.26	0.28	0.3	0.31	0.43	0.38
Basicity	1.50	1.82	1.73	1.84	1.82	1.50	1.47
Additional CaO [kg]	1031	1105	1101	1279	1058	1066	1253
Additional MgO [kg]	193	179	177	150	86	88	142
Additional SiO₂ [kg]	97	114	109	233	112	116	218



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Results

- **Energy consumption**



Usual consumption:

- 14 to 16 MWh electrical power
- 200 to 240 Nm^3 of natural gas



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Results

- **Energy consumption**
wheat starch bound briquettes

Heat nr.	Electrical energy consumption [MWh]	Natural gas [Nm ³]	
274035	14.67	228	additional
274036	15.12	233	
274037	15.51	236	
274103	14.58	216	replacement dolo lime
274104	14.53	225	
274105	15.57	233	
274180	14.7	208	Partly repl. of lime (+700 kg lime)
274181	16.72	275	
274182	15.97	249	
274278	15.53	228	Partly repl. of lime + dolo lime (+800 kg lime and + 250 kg dolo lime)
274279	14.3	223	
274280	16.29	237	
274281	16.72	243	



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Results

- **Energy consumption**
potato starch bound briquettes

Heat nr.	Electrical energy consumption [MWh]	Natural gas [Nm ³]	
275472	15.98	257	Partly repl. of lime (+700 kg lime)
275473	15.05	221	
275474	17.07	264	
275475	15.74	236	
275620	15.48	228	Partly repl. of lime + dolo lime (+800 kg lime and + 250 kg dolo lime)
275621	15.37	214	
275622	14.93	220	
275690	14.92	204	Replacement dolo lime (500 kg)
275808	15	236	
275809	13.81	222	
275689	14.55	217	Replacement dolo lime (1000 kg)
275810	14.7	256	



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Summary & Conclusion

- Industrial trials with briquetted LFS and HRS were executed in order to replace slag formers and to avoid landfill
- The trials were performed with 4 different types of briquettes
- The dissolution behaviour was excellent, no undissolved briquettes were recognized in the slag
- Generally no bad influence on the steel quality
- No increased energy consumption has been noticed



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Summary & Conclusion

- Trials with MH LFS bound by wheat starch
 - Most of the time there were no problems with deslagging and excavating
 - Some times a good foamy slag couldn't be achieved and the excavation was also more difficult
 - tougher and harder slag
- Trials with MH LFS & MAU HRS bound by potato starch
 - Most of the time there were problems with deslagging and excavating
 - flaming of slag
 - tougher and harder slag, especially when adding a bigger amount of briquettes
- Composition of the slag strongly depends on the scrap



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Thank you for your attention!