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Supporting information

Selective removal of zinc from BOF sludge by leaching with mixtures of ammonia and ammonium carbonate

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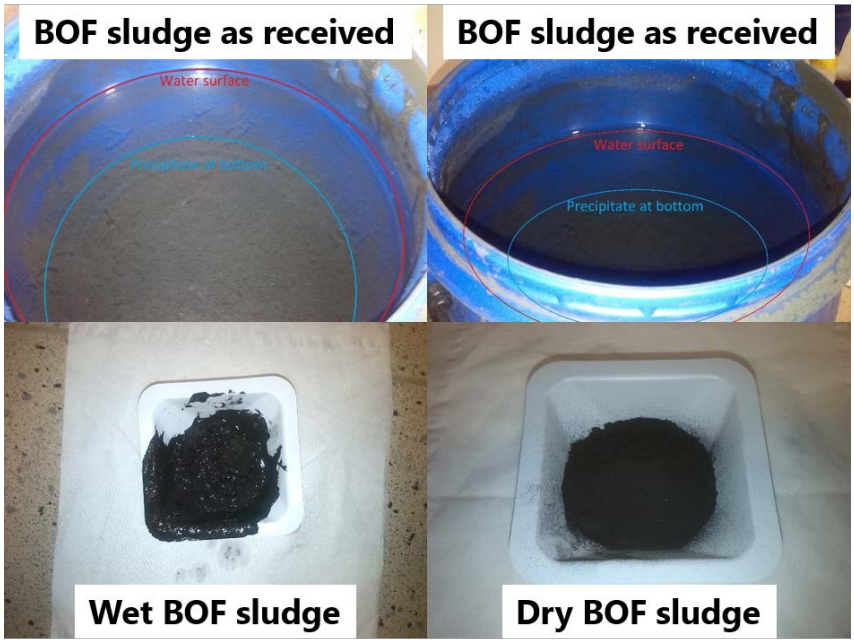

Fig. S1 Images of the BOF sludge material.

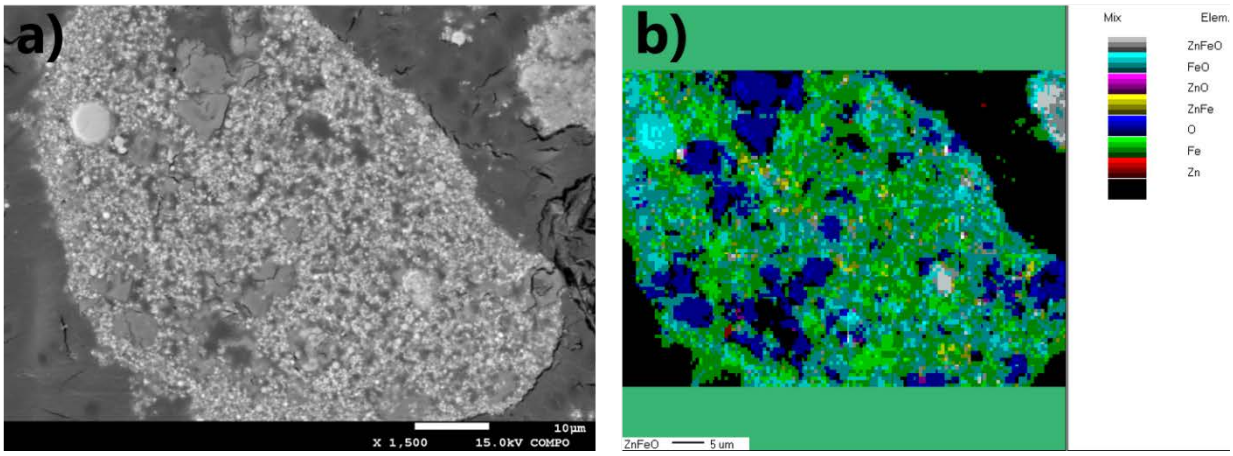

Fig. S2 EPMA measurements on BOF sample: (a) back-scattered electron (BSE) image and (b) superimposed elemental maps of Zn, O and Fe (scale in color intensity).

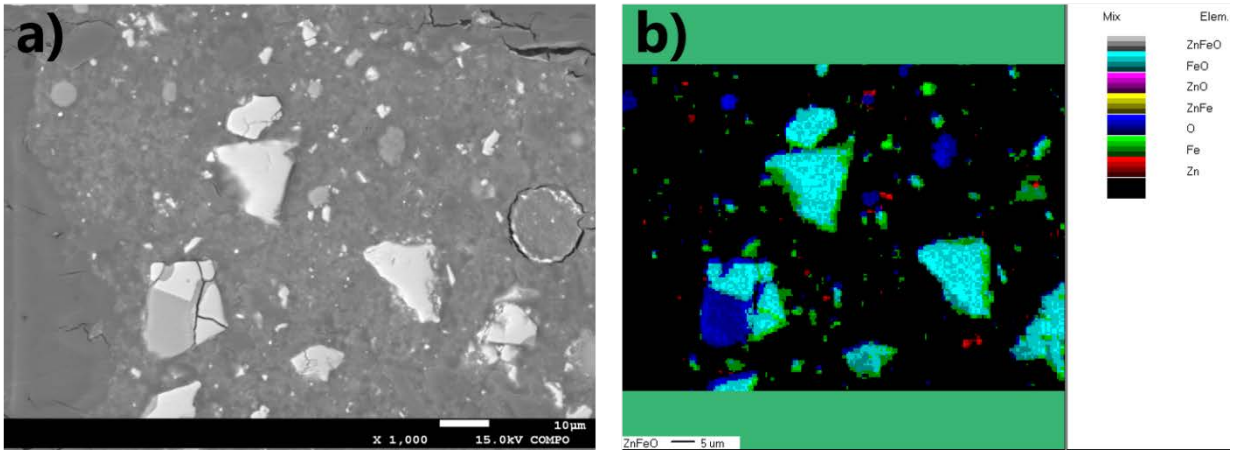

Fig S3 EPMA measurements on BOF sample: (a) back-scattered electron (BSE) image and (b) superimposed elemental maps of Zn, O and Fe (scale in color intensity).

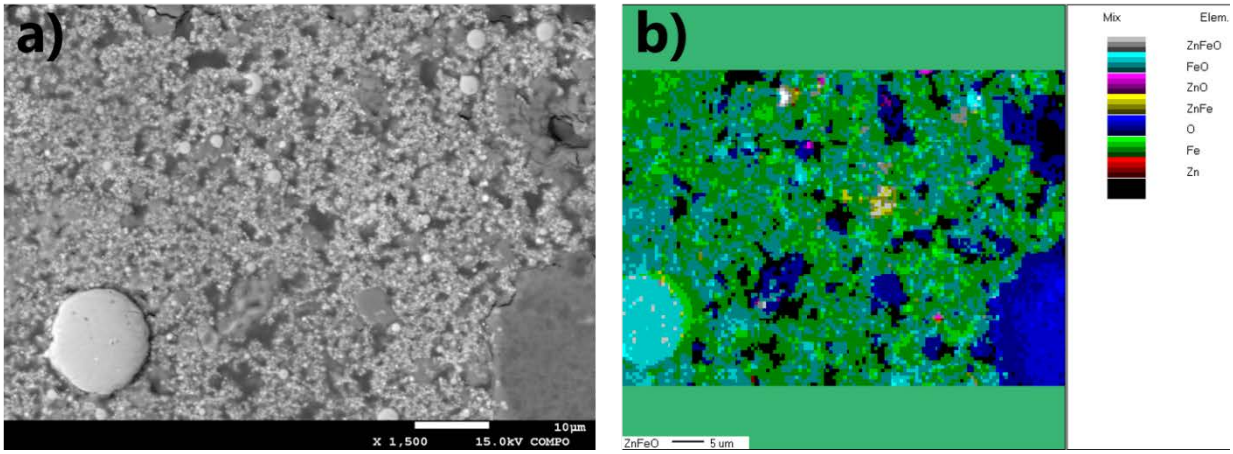

Fig S4 EPMA measurements on BOF sample: (a) back-scattered electron (BSE) image and (b) superimposed elemental maps of Zn, O and Fe (scale in color intensity)

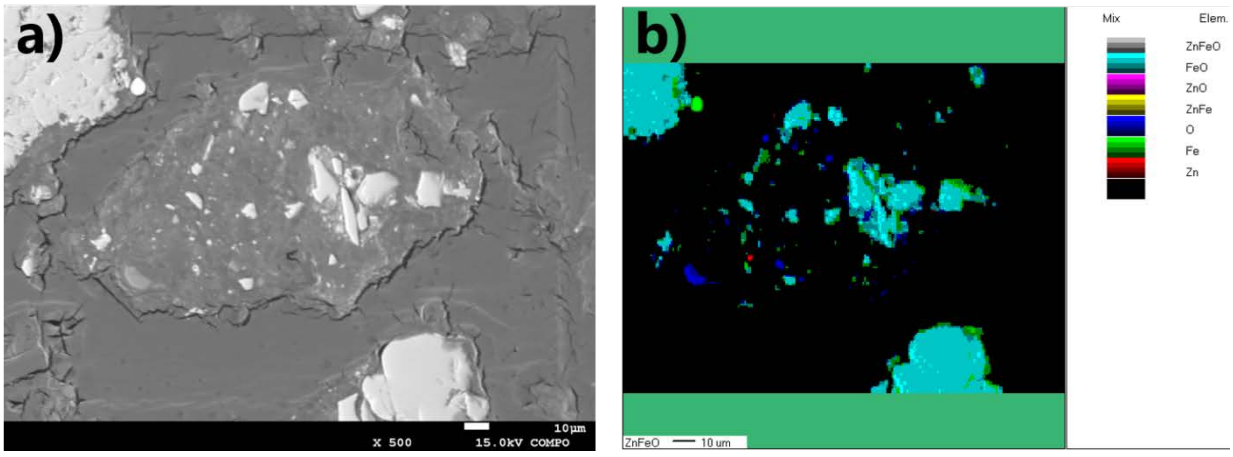

Fig S5 EPMA measurements on BOF sample: (a) back-scattered electron (BSE) image and (b) superimposed elemental maps of Zn, O and Fe (scale in color intensity).

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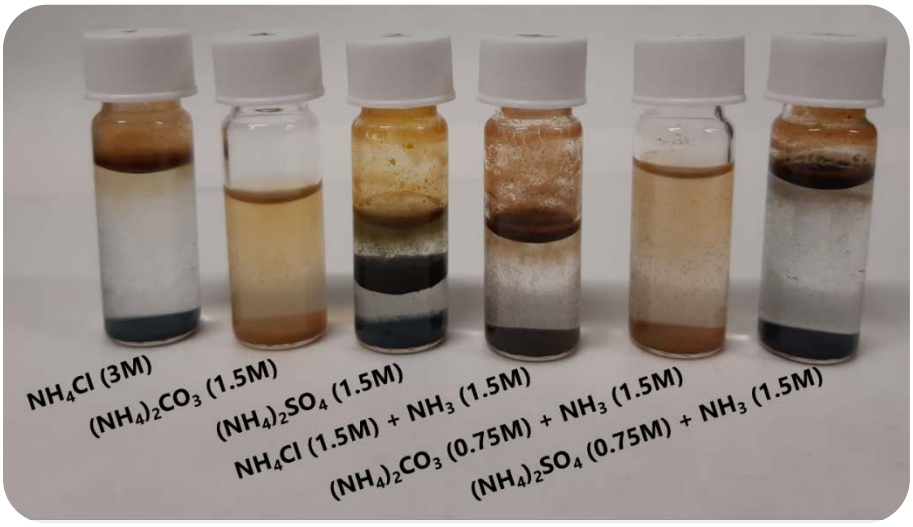

Fig. S6 Filtered BOF pregnant leach solutions after 24 h in a closed vial.

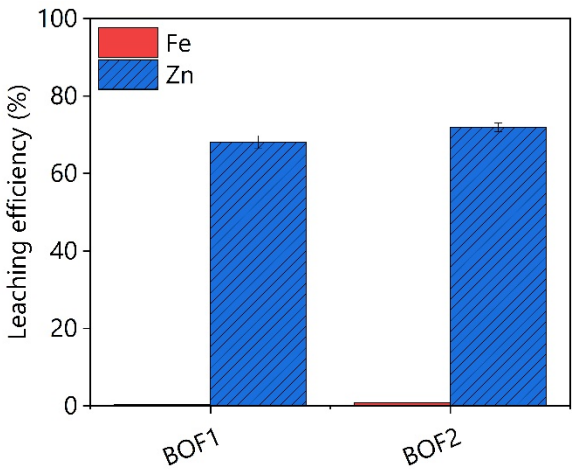

Fig. S7 Iron and zinc leaching efficiency of the two BOF sludges used in this work under identical leaching conditions: T = 60C; t = 3h; L/S = 10; $[NH_4^+ + NH_3]$ = 3 M; $(NH_4)_2CO_3$:NH_3 = 1:1.

Optimization of the leaching process

Table S1 Effect of the liquid-to-solid ratio on the composition of the PLS: Leaching conditions: T = 60 °C; t = 3 h; $[NH_4^+ + NH_3]$ = 3M; NH_4^+:NH_3 = 1:1

L/S (mL/g)	Fe (ppm)	Zn (ppm)
1	27±7	17972±800
2.5	364±33	11344±239
5	259±8	6640±265
10	433±31	4351±103

Table S2 Effect of the NH_4^+:NH_3 ratio on the composition of the PLS. Leaching conditions: T = 60 °C; t = 3 h; L/S = 10 mL/g; $[NH_4^+ + NH_3]$ = 3M

NH_4^+:NH_3 ratio	Fe (ppm)	Zn (ppm)
4:1	349±13	2780±108
2:1	264±17	3455±262
1:1	433±31	4351±103
1:2	287±29	4087±44
1:4	793±99	3783±125

Table S3 Effect of the total ammonia concentration $[NH_4^+ + NH_3]$ on the composition of the PLS. Leaching conditions: T = 60 °C; t = 3 h; L/S = 10 (mL/g); NH_4^+:NH_3 = 1:2

$[NH_4^+ + NH_3]$ (mol/L)	Fe (ppm)	Zn (ppm)
2	198±11	3260±75
3	287±29	4087±44
4	1054±48	4415±47
5	2358±242	4549±54
6	3919±259	4773±32

Fig. S8 Filtration cake of the BOF residue obtained after ammoniacal leaching in the 1 L reactor.

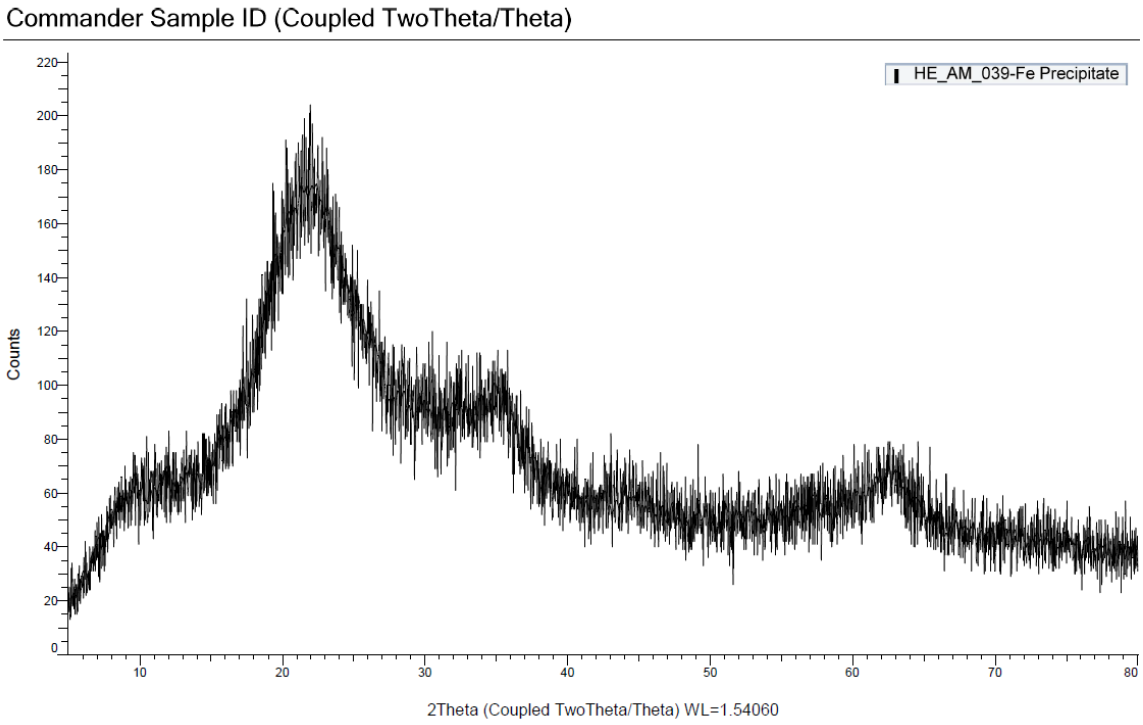

Fig. S9 XRD of the precipitate obtained from the iron precipitation step by air addition

Fig. S10 Precipitate obtained from the iron precipitation step by air addition