

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization

International Bureau

(43) International Publication Date  
01 December 2022 (01.12.2022)



(10) International Publication Number  
**WO 2022/248245 A1**

(51) International Patent Classification:

*C22B 1/00* (2006.01) *H01M 10/54* (2006.01)  
*C22B 7/00* (2006.01) *C21C 7/076* (2006.01)  
*C22B 23/02* (2006.01) *C22B 7/04* (2006.01)

Published:

- with international search report (Art. 21(3))
- in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE

(21) International Application Number:

PCT/EP2022/063010

(22) International Filing Date:

13 May 2022 (13.05.2022)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

21176046.7 26 May 2021 (26.05.2021) EP

(71) Applicant: **UMICORE** [BE/BE]; Rue du Marais 31, 1000 Brussels (BE).

(72) Inventors: **YAGI, Ryohei**; UMICORE, Watertorenstraat 33, 2250 Olen (BE). **SCHEUNIS, Lennart**; UMICORE, Watertorenstraat 33, 2250 Olen (BE).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- of inventorship (Rule 4.17(iv))

(54) Title: RECOVERY OF NICKEL AND COBALT FROM LI-ION BATTERIES OR THEIR WASTE

(57) Abstract: The present invention lies in the field of pyrometallurgy and discloses a process and a slag suitable for the recovery of Ni and Co from Li-ion batteries or their waste. The slag composition is defined according to:  $10\% < \text{MnO} < 40\%$ ;  $(\text{CaO} + 1.5 \cdot \text{Li}_2\text{O}) / \text{Al}_2\text{O}_3 > 0.3$ ;  $\text{CaO} + 0.8 \cdot \text{MnO} + 0.8 \cdot \text{Li}_2\text{O} < 60\%$ ;  $(\text{CaO} + 2 \cdot \text{Li}_2\text{O} + 0.4 \cdot \text{MnO}) / \text{SiO}_2 \geq 2.0$ ;  $\text{Li}_2\text{O} \geq 1\%$ ; and,  $\text{Al}_2\text{O}_3 + \text{SiO}_2 + \text{CaO} + \text{Li}_2\text{O} + \text{MnO} + \text{FeO} + \text{MgO} > 85\%$ . This composition is particularly adapted to limit or avoid the corrosion of furnaces lined with magnesia-bearing refractory bricks.



WO 2022/248245 A1