

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

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
02 February 2023 (02.02.2023)



(10) International Publication Number
WO 2023/009380 A3

(51) International Patent Classification:

C01G 15/00 (2006.01) C01G 35/00 (2006.01)
C01G 25/00 (2006.01) C30B 29/22 (2006.01)

(21) International Application Number:

PCT/US2022/037867

(22) International Filing Date:

21 July 2022 (21.07.2022)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

63/203,810 30 July 2021 (30.07.2021) US
63/273,833 29 October 2021 (29.10.2021) US

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(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, CV, 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).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments (Rule 48.2(h))

(88) Date of publication of the international search report:

11 May 2023 (11.05.2023)

(54) Title: LITHIUM LANTHANUM ZIRCONIUM OXIDE (LLZO) MATERIALS

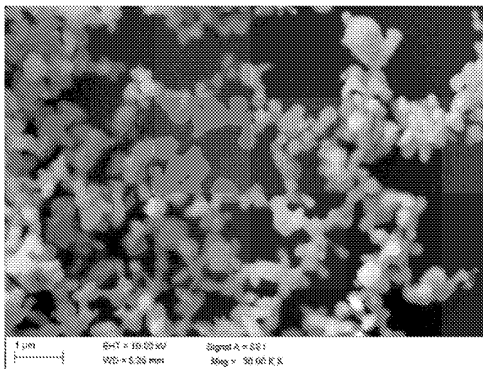


FIG. 5A

(57) Abstract: Disclosed herein are materials and processes for produc-
tion of lithium oxide materials, such as lithium lanthanum zirconium ox-
ide (LLZO), having a small particle size and high density for use in lithi-
um-ion batteries. Some embodiments are directed to forming and then
heating a multiphase material comprising lithium carbonate and $\text{La}_2\text{Zr}_2\text{O}_7$
in the presence of hydrogen gas at a temperature below the melting point
of the lithium carbonate, such that at least a portion of the lithium carbon-
ate decomposes to form lithium oxide. In some embodiments, the lithium
oxide is heated to a temperature sufficient to crystallize the lithium oxide
to form the solid electrolyte material comprising lithium lanthanum zir-
conium oxide (LLZO) particles.

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