

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

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
13 October 2022 (13.10.2022)



(10) International Publication Number
WO 2022/213152 A1

(51) International Patent Classification:
C25B 1/27 (2021.01) H01M 4/90 (2006.01)

(21) International Application Number:
PCT/AU2022/050309

(22) International Filing Date:
07 April 2022 (07.04.2022)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2021901015 07 April 2021 (07.04.2021) AU

(71) Applicant: **NEWSOUTH INNOVATIONS PTY LIMITED** [AU/AU]; Rupert Myers Building, Gate 14, The University of New South Wales, UNSW, Sydney, New South Wales 2052 (AU).

(72) Inventors: **DAIYAN, Rahman**; c/o NewSouth Innovations Pty Limited, Rupert Myers Building, Gate 14, The University of New South Wales, UNSW, Sydney, New South Wales 2052 (AU). **AMAL, Rose**; c/o NewSouth Innovations Pty Limited, Rupert Myers Building, Gate 14, The University of New South Wales, UNSW, Sydney, New South Wales 2052 (AU). **LOVELL, Emma**; c/o NewSouth Innovations Pty Limited, Rupert Myers Building, Gate 14, The University of New South Wales, UNSW, Sydney, New South Wales 2052 (AU). **JALILI, Ali (Rouhollah)**; c/o NewSouth Innovations Pty Limited, Rupert Myers Building, Gate 14, The University of New South Wales, UNSW, Sydney, New South Wales 2052 (AU).

(74) Agent: **SPRUSON & FERGUSON**; GPO BOX 3898, Sydney, New South Wales 2001 (AU).

(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, 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))



WO 2022/213152 A1

(54) Title: NO_x ACTIVATION TO AMMONIA

(57) Abstract: Metal oxide catalyst, preferably in a high surface area form, comprising a metal oxide (e.g. copper, cerium, tin or bismuth) having engineered surface defects in the form of oxygen vacancy defects. The engineered surface defects may be created by plasma treatment for a time sufficient to create oxygen vacancy defects while maintaining morphology and crystallinity of the metal oxide surface. Also a method of producing a metal oxide catalyst for NO_x reduction by preparing a high surface metal oxide catalyst and plasma treating the metal oxide particle to induce a controlled level of defects. Also, a method of producing NH₄⁺ from NO_x comprising depositing the metal oxide catalyst onto a substrate to provide an electrode, or a metal coordinated with nitrogen doped carbon, contacting the electrode with an aqueous solution containing NO_x species and applying a current to the electrode to reduce NO_x species to NH₄⁺/NH₃.