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(54) Title: DESODIATED SODIUM TRANSITION METAL OXIDES FOR PRIMARY BATTERIES

(57) Abstract: The invention provides primary batteries that incorporate a desodiated sodium transition metal oxide into the positive electrode (a cathode). Batteries of the invention using a desodiated sodium transition metal oxide in the cathode exhibit discharge voltages, battery capacities, and energy densities higher than a traditional Zn-MnO₂ dry cell battery, such as a commercially available AA battery. These batteries are also advantageous over comparable lithium ion batteries due to the high abundance and low cost of sodium precursor materials with similar electrical performance.



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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 20/26827

A. CLASSIFICATION OF SUBJECT MATTER

IPC - H01M 10/054; H01M 10/42; H01M 4/134 (2020.01)

CPC - H01M 10/054; H01M 4/364; H01M 4/525; H01M 2004/028

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

See Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 2018/0090758 A1 (UCHICAGO ARGONNE), 29 March 2018 (29.03.2018), para [0005], [0022]-[0024], [0046]-[0053].	1-3, 9-11 ----- 12
X	US 6,492,062 B1 (WANG et al), 10 December 2002 (10.12.2002), col 1 ln 34, col 2 ln 5-6, col 4 ln 30-33, col 5 ln 46-62.	1, 4-8
X	DOEFF et al, 'Orthorhombic Na _x MnO ₂ as a Cathode Material for Secondary Sodium and Lithium Polymer Batteries', Journal of the Electrochemical Society, volume 141, number 11, November 1994 (11.1994), pg L145-L147.	13-18
X	MA et al, 'Electrochemical Properties of Monoclinic NaMnO ₂ ', Journal of the Electrochemical Society, volume 158, number 12, 31 October 2011 (31.10.2011), pg A1307-A1312.	13, 19
Y	US 2011/0223477 A1 (NELSON et al), 15 September 2011 (15.09.2011), para [0004], [0006], [0010]-[0013], [0032], [0036], [0110].	12
A	WINTER et al, 'What Are Batteries, Fuel Cells, and Supercapacitors?', Chemical Reviews, volume 104, number 10, 28 September 2004 (28.09.2004), pg 4245-4270.	6

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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