

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
29 January 2009 (29.01.2009)

PCT

(10) International Publication Number  
**WO 2009/014775 A3**

(51) International Patent Classification:  
**H01M 8/12** (2006.01)

(21) International Application Number:  
PCT/US2008/060362

(22) International Filing Date: 15 April 2008 (15.04.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/962,054 25 July 2007 (25.07.2007) US

(71) Applicant (for all designated States except US): **THE REGENTS OF THE UNIVERSITY OF CALIFORNIA** [US/US]; 1111 Franklin Street, 12th Floor, Oakland, California 94607 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **TUCKER, Michael, C.** [US/US]; 413A 61st Street, Oakland, CA 94609 (US). **LAU, Grace, Y.** [CA/US]; 21265 Stevens Creek Boulevard, #E205-418, Cupertino, California 95014 (US). **JACOBSON, Craig, P.** [US/US]; 132 Tharp Drive, Moraga, CA 94556 (US).

(74) Agents: **AUSTIN, James, E.** et al.; WEAVER AUSTIN VILLENEUVE & SAMPSON LLP, P. O. Box 70250, Oakland, California 94612-0250 (US).

(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, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

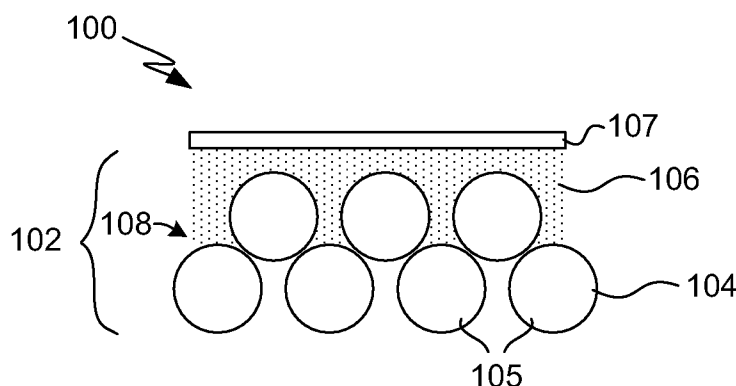
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT,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

**Published:**

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:  
12 March 2009

(54) Title: HIGH TEMPERATURE ELECTROCHEMICAL DEVICE WITH INTERLOCKING STRUCTURE



**FIG. 1A**

(57) Abstract: Layered structures and associated fabrication methods that serve as the foundation for preparing high-operating-temperature electrochemical cells have a porous ceramic layer and a porous metal support or current collector layer bonded by mechanical interlocking which is provided by interpenetration of the layers and/or roughness of the metal surface. The porous layers can be infiltrated with catalytic material to produce a functioning electrochemical electrode.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 08/60362

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H01M 6/30, 6/38 (2008.04)

USPC - 429/145

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)

USPC - 429/145, 115

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
USPC - 429/27, 30, 40, 41, 44, 45, 129, 142, 144, 162. IPC(8) - H01M 4/00, 8/10, 2/14, 2/16, 6/46. (Term search-- see search terms below).

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
PubWEST(USPT,PGPB,EPAB,JPAB); Dialogweb (344, 347, 348, 349, 371, 652, 654, 345, 351, 315, 35, 440); Google Patents. Search terms: electrochemical, electricity, cell, device, fuel cell, porous, pore, metal, ceramic, layer, stratum, interlock\$, interpenetrat\$, interface, fuse\$, sinter\$, boundary, nickel, silver, paste, YSZ.

## 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 6,007,683 A (JANKOWSKI, et al.) 28 December 1999 (28.12.1999), entire document, especially cols. 2, 4, 5; col. 8, ln 31-35, FIG. 1.	1, 2, 11, 21, 23, 27-30, 33, 42, 45, 52, 54, 61 ----- 3-10, 12-20, 22, 24-26, 31, 32, 34-41, 43, 44, 46-51, 53, 55-60
Y	WO 2006091250 A2 (TUCKER, et al.) 31 August 2006 (31.08.2006), entire document, especially pages 4-9; FIGS 5, 6.	3-10, 12-20, 26, 32, 34-41, 43, 47, 48, 50, 51, 60 20, 22, 44, 51, 53, 58, 59
Y	US 2005/0271931 A1 (FINNERTY) 8 December 2005 (08.12.2005), paras [0034]-[0037], [0050], [0051], [0057], [0059], [0067].	24, 25, 55-57
Y	US 4,847,172 A (MASKALICK, et al.) 11 July 1989 (11.07.1989), abstract, FIG. 2.	31, 34-37, 49-51
Y	US 6,682,842 B1 (VISCO, et al.) 27 January 2004 (27.01.2004), abstract; col. 4, ln 55-64; col. 5, ln 41-44; col. 6, ln 24-27.	10, 46
Y	US 6,767,662 B2 (JACOBSON, et al.) 27 July 2004 (27.07.2004), col. 9, ln 28-33.	57
Y	US 2004/0028994 A1 (AKIKUSA, et al.) 12 February 2004 (12.02.2004), paras [0037] [0075], [0076], FIG. 3.	

☒ Further documents are listed in the continuation of Box C.


\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

8 December 2008 (08.12.2008)

Date of mailing of the international search report

12 JAN 2009

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents  
P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300  
PCT OSP: 571-272-7774

SB

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 08/60362

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6,420,064 B1 (GHOSH, et al.) 16 July 2002 (16.07.2002), entire document, especially abstract, FIG. 1.	1-21, 23-44, 47-52, 54-56, 60, 61
A	US 6,428,920 B1 (BADDING, et al.) 6 August 2002 (06.08.2002), entire document, especially abstract.	1-21, 23-44, 47-52, 54-56, 60, 61
A	US 2003/0224234 A1 (STEELE, et al.) 4 December 2003 (04.12.2003), abstract.	8, 12, 41, 43
A	US 5,629,103 A (WERSING, et al.) 13 May 1997 (13.05.1997), abstract.	3, 14-19, 24, 25, 30, 49, 50, 55, 56
A	US 6,800,323 B2 (PAN) 5 October 2004 (05.10.2004), abstract.	31, 45-48