

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

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
17 July 2003 (17.07.2003)

PCT

(10) International Publication Number
WO 03/058668 A3

(51) International Patent Classification⁷: **H01J 9/02**, 3/02

MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW.

(21) International Application Number: PCT/US02/40764

(22) International Filing Date:
20 December 2002 (20.12.2002)

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10/035,766 26 December 2001 (26.12.2001) US

Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for all designations
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for all designations

(71) Applicant: **EXTREME DEVICES INCORPORATED**
[US/US]; 3500 ComSouth, Austin, TX 78744 (US).

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

(72) Inventors: **SCHUELLER, Randolph, D.**; 11139 Callanish Park Drive, Austin, TX 78750 (US). **HONG, Charlie, C.**; 9301 Mystic Oak Trail, Austin, TX 78750 (US).

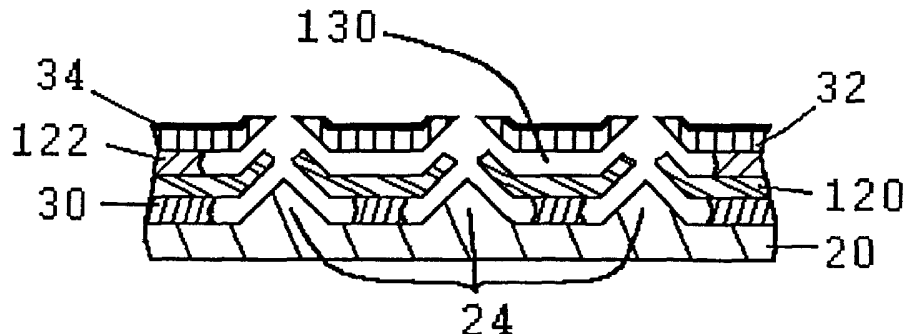
(74) Agent: **COOKE, Claude, E., Jr.**; Baker Botts, L.L.P., One Shell Plaza, 910 Louisiana, Houston, TX 77002-4995 (US).

(88) Date of publication of the international search report:
4 September 2003

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: GATED ELECTRON FIELD EMITTER HAVING SUPPORTED GATE



(57) Abstract: A field emission device having emitter tips and a support layer for a gate electrode is provided. Openings in the support layer and the gate layer are sized to provide mechanical support for the gate electrode. Cavities may be formed and mechanically supported by walls between cavities or columns within cavity. Dielectric layers having openings of different sizes between the emission tips and the gate electrode can decrease leakage current between emitter tips and the gate layer. The emitter tips may comprise a carbon-based material. The device can be formed using processing operations similar to those used in conventional semiconductor device manufacturing.



WO 03/058668 A3

INTERNATIONAL SEARCH REPORT

Internationa Application No	PCT/US 02/40764
-----------------------------	-----------------

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 H01J9/02 H01J3/02

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)
 IPC 7 H01J

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
 PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category ^o	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 6 075 315 A (SEKO NOBUYA ET AL) 13 June 2000 (2000-06-13) column 3, line 15 - line 20 column 6, line 1 - line 31 column 7, line 42 - line 46 ---	1,2,7 15
X Y	US 6 066 507 A (CATHEY DAVID A ET AL) 23 May 2000 (2000-05-23) column 1, line 38; figure 5 column 3, line 39 -column 5, line 55 ---	15,19, 23,24 16-18, 20-22
Y	US 6 121 066 A (OH MYUNG HWAN ET AL) 19 September 2000 (2000-09-19) column 2, line 1-5 ---	16-18, 20-22
	-/--	

Further documents are listed in the continuation of box C. Patent family members are listed in annex.

^o Special categories of cited documents:

<p>*A* document defining the general state of the art which is not considered to be of particular relevance</p> <p>*E* earlier document but published on or after the international filing date</p> <p>*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)</p> <p>*O* document referring to an oral disclosure, use, exhibition or other means</p> <p>*P* document published prior to the international filing date but later than the priority date claimed</p>	<p>*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</p> <p>*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</p> <p>*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.</p> <p>* & * document member of the same patent family</p>
--	--

Date of the actual completion of the international search 17 July 2003	Date of mailing of the international search report 30/07/2003
--	---

Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Oestreich, S
--	---

INTERNATIONAL SEARCH REPORT

Internal	Application No
PCT/US	02/40764

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 1999, no. 13, 30 November 1999 (1999-11-30) & JP 11 213864 A (TOSHIBA CORP), 6 August 1999 (1999-08-06) abstract ---	1-24
A	US 5 499 938 A (NAKAMOTO MASAYUKI ET AL) 19 March 1996 (1996-03-19) the whole document ---	1-24
A	EP 0 639 847 A (TOKYO SHIBAURA ELECTRIC CO) 22 February 1995 (1995-02-22) column 5, line 59 -column 6, line 28; figure 9 ---	1-24
A	US 5 886 460 A (JONES GARY W ET AL) 23 March 1999 (1999-03-23) the whole document -----	1-24

INTERNATIONAL SEARCH REPORT

ation on patent family members

Intern: Application No

PCT/US 02/40764

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 6075315	A	13-06-2000	JP 3070469 B2	31-07-2000
			JP 8321255 A	03-12-1996
			FR 2734401 A1	22-11-1996
			KR 223203 B1	15-10-1999
US 6066507	A	23-05-2000	US 5696028 A	09-12-1997
			US 5372973 A	13-12-1994
			US 5229331 A	20-07-1993
			US 5831378 A	03-11-1998
			DE 4304103 A1	19-08-1993
			JP 3098483 B2	16-10-2000
			JP 10188784 A	21-07-1998
			JP 2836802 B2	14-12-1998
			JP 6084454 A	25-03-1994
US 6121066	A	19-09-2000	NONE	
JP 11213864	A	06-08-1999	NONE	
US 5499938	A	19-03-1996	JP 3253683 B2	04-02-2002
			JP 6036682 A	10-02-1994
			JP 3231528 B2	26-11-2001
			JP 7111132 A	25-04-1995
			US 6281621 B1	28-08-2001
			DE 4310604 A1	20-01-1994
			KR 133498 B1	22-04-1998
			DE 69403940 D1	31-07-1997
			DE 69403940 T2	11-12-1997
			EP 0639847 A1	22-02-1995
EP 0639847	A	22-02-1995	JP 3231528 B2	26-11-2001
			JP 7111132 A	25-04-1995
			DE 69403940 D1	31-07-1997
			DE 69403940 T2	11-12-1997
			EP 0639847 A1	22-02-1995
			US 5499938 A	19-03-1996
			US 6281621 B1	28-08-2001
US 5886460	A	23-03-1999	US 5844351 A	01-12-1998
			EP 0876676 A2	11-11-1998
			JP 2000500266 T	11-01-2000
			WO 9709731 A2	13-03-1997