

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
18 November 2004 (18.11.2004)

PCT

(10) International Publication Number
WO 2004/099068 A3

- (51) International Patent Classification⁷: **B32B 5/16**, (US). **WHITEFORD, Jeffery, A.** [US/US]; 1908 Valdez Avenue, Belmont, CA 94002 (US).
D04H 3/00, 5/00, 13/00
- (21) International Application Number: PCT/US2004/014006 (74) Agents: **QUINE, Jonathan, Alan** et al.; Quine Intellectual Property Law Group, P.C., P.O. Box 458, Alameda, CA 94501 (US).
- (22) International Filing Date: 5 May 2004 (05.05.2004) (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, 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, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
60/468,606 5 May 2003 (05.05.2003) US
60/468,390 6 May 2003 (06.05.2003) US
10/792,402 2 March 2004 (02.03.2004) US
- (71) Applicant (for all designated States except US): **NANOSYS, INC.** [US/US]; 2625 Hanover Street, Palo Alto, CA 94304 (US). (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, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **DUBROW, Robert** [US/US]; 766 Orange Avenue, San Carlos, CA 94070 (US). **DANIELS, Hugh** [GB/US]; 1144 Katie Court, Mountain View, CA 94040 (US). **PARCE, J., Wallace** [US/US]; 754 Los Robles Avenue, Palo Alto, CA 94306 (US). **MURPHY, Matthew** [US/US]; 1439 16th Avenue, San Francisco, CA 94122 (US). **HAMILTON, Jim** [US/US]; 480 Southwood Avenue, Sunnyvale, CA 94086 (US). **SCHER, Erik** [US/US]; 1040A Guerrero Street, San Francisco, CA 94110 (US). **STUMBO, Dave** [US/US]; 1561 6th Avenue, Belmont, CA 94002 (US). **NIU, Chunming** [US/US]; 81 Fottler Avenue, Lexington, MA 02420 (US). **ROMANO, Linda, T.** [US/US]; 1055 Westchester Drive, Sunnyvale, CA 94087 (US). **GOLDMAN, Jay** [US/US]; 521 Main Street, #2, Medford, MA 02155 (US). **SAHI, Vijendra** [CA/US]; 256 Marmona Drive, Menlo Park, CA 94025
- 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: 21 April 2005
- 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.



WO 2004/099068 A3

(54) Title: NANOFIBER SURFACES FOR USE IN ENHANCED SURFACE AREA APPLICATIONS

(57) Abstract: The invention provides novel nanofiber enhanced surface area substrates and structures comprising such substrates, as well as methods and uses for such substrates.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/14006

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B32B 5/16; D04H 3/00, 5/00, 13/00
 US CL : 428/221,292.1,323,332; 442/327,330,334,361,376,394,400,401,402,417
 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)
 U.S. : 428/221,292.1,323,332; 442/327,330,334,361,376,394,400,401,402,417

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

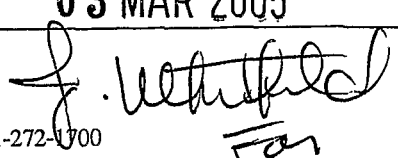
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
 EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2003/0059742 A1 (WEBSTER et al.) 27 March 2003 (27.03.2003), Abstract and paras. 26-27, and 34)	1-25, 83, 93-94, 97-99, 192, and 199-200
X	US 6,099,965 (TENNETT et al.) 08 August 2000 (08.08.2000), Abstract, col. 4, lines 58-67, col. 6, lines 37-40, 48-51, col. 7, line 66 - col. 8, line 2, col. 14, lines 30-34, and col. 22, lines 28-31.	1-25, 93-94, and 97-99
X	US 2002/0092423 A1 (GILLINGHAM et al.) 18 July 2002 (18.07.2002), Abstract, paras. 9, 19, 21, 24 and 25).	1-25, 93-94, and 97-99
X	US 6,362,011 B1 (MASSEY et al.) 26 March 2002 (26.03.2002), Abstract, col. 7, lines 45-60, col. 11, lines 42-54, col. 16, lines 14-25, and col. 18, lines 23-28).	1-25, 93-94; and 97-99
X	US 6,261,861 B2 (GAO et al.) 26 March 2002 (26.03.2002), Abstract, col. 4, lines 20-25, 32-45	1-25, 93-94, and 97-99
A, P	US 6,811,957 B1 (MAU et al.) 02 November 2004 (02.11.2004)	
A, P	US 2003/0119920 A1 (WANG et al.) 26 June 2003 (26.06.2003)	
A, P	US 2004/0018371 A1 (MAO) 29 January 2004 (29.01.2004)	

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

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent published on or after the international filing date	"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
"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)	"&"	document member of the same patent family
"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		

Date of the actual completion of the international search 07 February 2005 (07.02.2005)	Date of mailing of the international search report 03 MAR 2005
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. (703) 305-3230	Authorized officer Terrel Morris  Telephone No. 571-272-1700

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/14006

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
Please See Continuation Sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-25,83,93,94,97-99,192,199 and 200

Remark on Protest

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/14006

BOX III. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

The inventions listed as Groups 1-11 do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: Groups 1-10 are related as they all discuss a plurality of nanofibers attached to a first surface; and, one or more specific moiety attached to or associated with one or more member of the plurality of nanofibers. Group 1 has been searched for this search report.

Groups 1 and 2 are different in that Group 2 recites the inclusion of nanoparticles within the plurality of nanofibers. Group 1 does not mention the inclusion of nanoparticles.

Groups 1 and 3 are different in that Group 3 recites a substrate comprising multiple regions of nanofibers. Group 1 does not mention this technical feature.

Groups 1 and 4 are different in that Group 4 recites a substrate comprising a separation substrate. Group 1 does not mention this technical feature.

Groups 1 and 5 are different in that Group 5 recites the inclusion of one or more sources of material to be separated and a fluid delivery device. Group 1 does not mention this technical feature.

Groups 1 and 6 are different in that Group 6 recites the inclusion of mass spectrometry with an associated laser. Group 1 does not mention this technical feature.

Groups 1 and 7 are different in that Group 7 recites an analyte to be assayed via mass spectrometry. Group 1 does not mention this technical feature.

Groups 1 and 8 are different in that Group 8 recites that the surface of the nanofibers are to have an anti-biofouling surface. Group 1 does not mention this technical feature.

Groups 1 and 9 are different in that Group 9 recites a reservoir of one or more substances within the nanofiber region. Group 1 does not mention this technical feature.

Groups 1 and 10 are different in that Group 10 recites contacting a mixture with the substrate and identifying the presence of a material within said mixture via moiety interaction. Group 1 does not mention this technical feature.

Groups 1 and 11 are unrelated in that Group 11 does not recite the use of nanofibers.

Most importantly, Groups 1-10 lack unity as the technical feature of a plurality of nanofibers attached to a first surface; and, one or more specific moiety attached to or associated with one or more member of the plurality of nanofibers does not make a contribution over prior art. Tennent et al. (US Patent 6,031,711) describes the use of a substrate of functionalized graphitic nanofibers

i.e. nanofibers whose surfaces are uniformly or non-uniformly modified so as to have a functional chemical moiety associated therewith (col. 15, lines 45-50).