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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
6 May 2004 (06.05.2004)

PCT

(10) International Publication Number
WO 2004/038037 A3

(51) International Patent Classification[7]: G06F 19/00

(21) International Application Number:
PCT/US2003/029726

(22) International Filing Date:
22 September 2003 (22.09.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

10/251,152	20 September 2002 (20.09.2002)	US
10/667,004	19 September 2003 (19.09.2003)	US

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(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, 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, 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, UZ, VC, VN, YU, ZA, ZM, ZW.

(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, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

(88) Date of publication of the international search report:
11 November 2004

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: CONTROLLED ALIGNMENT OF NANO-BARCODES ENCODING SPECIFIC INFORMATION FOR SCANNING PROBE MICROSCOPY (SPM) READING

(57) Abstract: The methods, apparatus and compositions disclosed herein concern the detection, identification and/or sequencing of biomolecules, such as nucleic acids or proteins. In certain embodiments of the invention, coded probes comprising a probe molecule attached to one or more nano-barcodes may be allowed to bind to one or more target molecules. After binding and separation from unbound coded probes, the bound coded probes may be aligned on a surface and analyzed by scanning probe microscopy. The nano-barcodes may be any molecule or complex that is distinguishable by SPM, such as carbon nanotubes, fullerenes, submicrometer metallic barcodes, nanoparticles or quantum dots. Where the probes are oligonucleotides, adjacent coded probes hybridized to a target nucleic acid may be ligated together before alignment and SPM analysis. Compositions comprising coded probes are also disclosed herein. Systems for biomolecule analysis may comprise an SPM instrument and at least one coded probe attached to a surface.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/29726

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G06F 19/00

US CL : 702/20

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. : 702/19, 20; 703/11; 435/6

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)

Please See Continuation Sheet

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 5,538,898 A (WICKRAMASINGHE et al.) 23 July 1996 (23.07.1996), see entire disclosure.	1-3 & 6-28 --- 4 & 5
Y	US 4,053,433 A (LEE) 11 October 1977 (11.10.1977), see entire disclosure.	1-18
X	WO 97/15390 A1 (UNIVERSITY OF HERTFORDSHIRE) 01 May 1997 (01.05.1997), see entire disclosure.	1 & 5
X	US 6,432,715 B1 (NELSON et al.) 13 August 2002 (13.08.2002), see especially column 3, line 50, through column 12, line 28.	1 & 5
X	US 3,772,200 A (LIVESAY) 13 November 1973 (13.11.1973), see entire disclosure.	1 & 5
P,X --- P,Y	US 6,537,755 B1 (DRMANAC) 25 March 2003 (25.03.2003), see especially column 4, line 66, through column 6, line 50.	1-3,5-8, & 15-18 --- 4 & 9

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

* Special categories of cited documents:

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"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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 July 2004 (31.07.2004)	25 AUG 2004
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) 872-9306	Authorized officer Ardin Marschel Telephone No. (571) 272-1600

Form PCT/ISA/210 (second sheet) (July 1998)

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INTERNATIONAL SEARCH REPORT

C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 5,451,505 A (DOLLINGER) 19 September 1995 (19.09.1995), see especially the section entitled "SUMMARY OF THE INVENTION" in columns 1-7.	1-3,6-8, & 15-18 --- 4 & 9
A	BLONDEL et al. Giant magnetoresistance of nanowires of multilayers, Appl. Phys. Lett. 05 December 1994, Volume 65, Number 23, pages 3018-3021.	1-28
A	PIRAUX al. Giant magnetoresistance in magnetic multilayered nanowires, Appl Phys. Lett., 07 November 1994, Volume 65, Number 19, pages 2484-2486.	1-28
A	MARTIN et al. Orthogonal Self-Assembly on Colloidal Gold-Platinum Nanorods, Advanced Materials, 1999, Volume 11, Number 12, pages 1021-1025.	1-28
A	MARTIN. Membrane-Based Synthesis of Nanomaterials. Chem. Mater., 1996, Volume 8, pages 1739-1746.	1-28

Continuation of B. FIELDS SEARCHED Item 3:
WEST,CAS,BIOSIS,WPI,EMBASE,MEDLINE,BIOTECH ABS covering terms: nanocode, nanobar, alignment,scanning, probe, nanotube, oligonucletide, nucleic, acid, ligate, adjacent, quantum, dots, fullerenes, sequence, combing, microscope,identify, surface, atomic, and force