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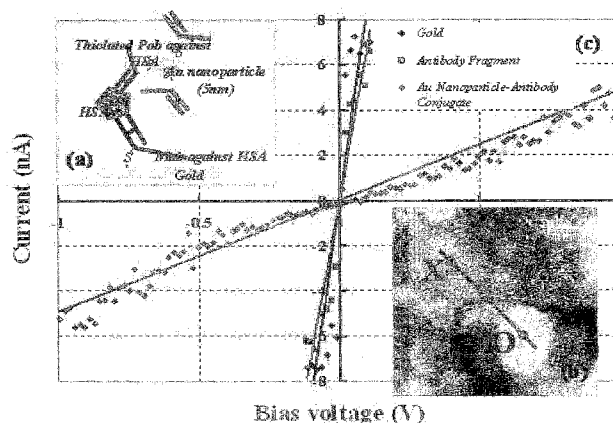
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[Continued on next page]

(54) Title: METHODS FOR ELECTRICALLY DETECTING INTERACTIONS BETWEEN BIOMOLECULES USING SCANNING TUNNELING MICROSCOPE

Fig. 4



(57) Abstract: The present invention relates to a method for electrically detecting an interaction between biomolecules using a scanning tunneling microscope (STM), comprising the steps of: (a) immobilizing a first biomolecule on a metal substrate; (b) applying a second biomolecule to the metal substrate to induce the interaction between the first biomolecule and the second biomolecule; and (c) scanning the metal substrate using STM to measure an electric signal, whereby the occurrence of the interaction between the first and the second biomolecules is determined. The present STM-based electrical detection method enables to detect analytes having much lower concentrations {e.g., 100 fg/mL}. In addition, the method of the present invention allows multiple detections in a single measurement system {e.g., single protein chip}. On the other hand, the present invention permits to successfully analyze a nano-size array of which detection is impossible in a conventional method based on the fluorescence and allows ultrahigh sensitivity by signal enhancement through silver staining of Au nanoparticles.



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A. CLASSIFICATION OF SUBJECT MATTER**G01N 13/12(2006.01)i**

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: G01N 33/554, G01N 33/569, G01N 33/53, G01N 33/542, C12Q 1/70, C12Q 1/68, C12M 1/34

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

Korean Utility models and applications for Utility Models since 1975

Japanese Utility models and applications for Utility Models since 1975

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

eKOMPASS(KIPO internal) & keywords: "STM", "bio-molecule", "detection"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2003/0134273 A1 (HENDERSON, ERIC) 17 JULY 2003 See abstract; paragraphs [0019]-[0078].	1-5,7
A		6,8-10
X	SAUTHIER, M. L. et al., Nanoparticle Layers Assembled through DNA Hybridization: Characterization and Optimization, Langmuir, 2002, Vol.18, No.5, pages 1825-1830 See Fig.1; abstract; pages 1825-1826.	1
A	US 2006/0035234 A1 (HENDERSON, ERIC et al.) 16 FEBRUARY 2006 See abstract; claims.	1-10
A	WANG, J. et al., Silver-Enhanced Imaging of DNA Hybridization at DNA Microarrays with Scanning Electrochemical Microscopy, Langmuir, 2002, Vol.18, pages 6653-6658 See the whole document.	1-10



Further documents are listed in the continuation of Box C.



See patent family annex.

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"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

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"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2003-0134273 A1	17.07.2003	AU 2002-329606 A8 WO 2003-008941 A2 WO 2003-008941 A3	17.07.2002 30.01.2003 30.01.2003
US 2006-0035234 A1	16.02.2006	AU 2003-300156 A1 AU 2003-300156 A1 CA 2512181 A1 EP 1583845 A4 EP 1583845 A2 JP 2006-512583 A KR 10-2005-0100367 A US 07344832 B2 WO 2004-060044 A2 WO 2004-060044 A3	30.12.2003 29.07.2004 22.07.2004 28.06.2006 12.10.2005 13.04.2006 18.10.2005 18.03.2008 22.07.2004 22.07.2004