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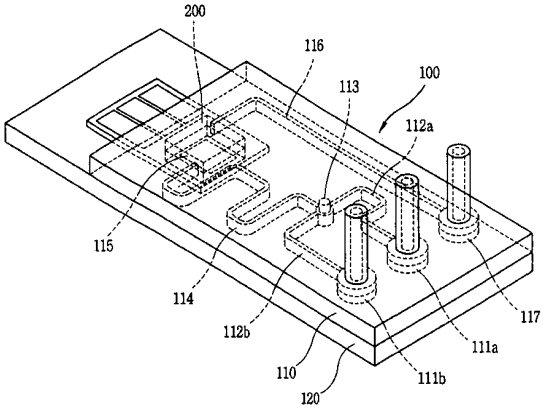
(54) **Quantitative biopolymer detecting system using monolithic piezoelectric cantilever by resonant frequency shift, method for fabricating the same system and method for detecting biopolymer quantitatively using the same system**

(57) A method for detecting a small amount of biopolymer by using resonant frequency shift of PZT monolithic cantilever system using a cantilever includes: an infinitesimal fluid transfer system having an inlet for allowing a reactant to be injected therethrough and an infinitesimal introduction channel for connecting the inlet and a reaction chamber; and a cantilever sensor installed in the reaction chamber and having a cantilever with one end fixed at a substrate, a piezoelectric capacitor for self-sensing and actuating on at least one side of an upper surface and a lower surface of the cantilever including a piezoelectric film, a lower electrode formed at a lower surface of the piezoelectric film and an upper electrode formed at an upper surface of the piezoelectric film, an electric pad for applying electricity to the lower electrode and the upper electrode, and a molecular recognition layer formed at at least one surface of the cantilever and so as to interact to an target biopolymer. Actuating and sensing can be applied to the cantilever using monolithic PZT cantilever without using an additional external actuator, so that the size of the cantilever sensor can be considerably reduced and coupled to a fine fluid transfer system to measure a very small amount of biopolymer.

Figure 1



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EUROPEAN SEARCH REPORT

Application Number
EP 04 01 2222

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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X	US 2003/215865 A1 (MAYER THERESA S ET AL) 20 November 2003 (2003-11-20) * abstract; figures 1,2,9 * * paragraph [0004] - paragraph [0023] * * paragraph [0034] - paragraph [0043] * * paragraph [0049] - paragraph [0053] * * paragraph [0063] - paragraph [0076] * -----	1,19,20	
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X	WO 98/50773 A (UNIVERSITY OF MINNESOTA) 12 November 1998 (1998-11-12) * abstract; figures 1,10 * * page 10, line 28 - page 13, line 32 * -----	1	

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
Munich	3 May 2005	Uttenthaler, E

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1 (part), 2-26

European Patent Office

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 04 01 2222

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1 (part), 2-26

   Biopolymer detection with resonating piezoelectric monolithic cantilever system, the cantilever having a parylene insulation film.
   Technical Problem: Preventing electrical conduction in a liquid

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2. claims: 27-31

   Fabrication of a resonating piezoelectric monolithic cantilever system by combining micromaching and molding techniques
   Technical Problem: Fabrication of an integrated biopolymer detection system with combined sensor and fluid components

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3. claims: 1 (part), 2 (part), 32-37,42

   Biopolymer detection with resonating piezoelectric monolithic cantilever system, the cantilever having an antibody coating and the pressure in the analyte sample is lowered during the reaction cycle
   Technical Problem: Increasing the reaction efficiency between the coated molecular recognition layer and the analyte sample

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4. claims: 1 (part), 38,39

   Blood characterization with resonating piezoelectric monolithic cantilever system by determining viscosity and density and, thus, the amount of red blood cells.
   Technical Problem: Measuring the degree of illness.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 04 01 2222

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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03-05-2005

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

专利名称(译)	通过共振频移使用单片压电悬臂的定量生物聚合物检测系统，制造该系统的方法和使用相同系统定量检测生物聚合物的方法		
公开(公告)号	EP1536227A3	公开(公告)日	2005-07-27
申请号	EP2004012222	申请日	2004-05-24
[标]申请(专利权)人(译)	韩国科学技术研究院		
申请(专利权)人(译)	韩国学院科技		
当前申请(专利权)人(译)	韩国学院科技		
[标]发明人	KIM TAE SONG HWANG KYO SEON PARK JAE BUM LEE JEONG HOON		
发明人	KIM, TAE SONG HWANG, KYO SEON PARK, JAE BUM LEE, JEONG HOON		
IPC分类号	G01N33/53 B01L3/00 B81B3/00 B81C99/00 G01N5/02 G01N27/00 G01N29/02 G01N29/036 G01N29/44 G01N33/543 G01N33/566 G01N33/96 G01N37/00		
CPC分类号	G01N29/4436 B01L2300/0663 B01L2300/0816 B01L2300/0867 B01L2300/0887 B01L2400/0487 B82Y30/00 B82Y35/00 G01N29/022 G01N29/036 G01N33/54373 G01N2291/0256 G01N2291/0426 G01N2291/0427		
优先权	1020030084160 2003-11-25 KR		
其他公开文献	EP1536227A2		
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摘要(译)

通过使用悬臂的PZT整体式悬臂系统的共振频移来检测少量生物聚合物的方法包括：无限小的流体传输系统，其具有允许反应物通过其注入的入口和用于连接入口和的入口的无穷小引入通道。反应室;悬臂传感器安装在反应室中并具有悬臂，其一端固定在基板上，压电电容器用于在包括压电薄膜的悬臂的上表面和下表面的至少一侧上自感测和致动，形成在压电薄膜的下表面的下电极和形成在压电薄膜的上表面的上电极，用于向下电极和上电极通电的电焊盘，以及在其形成的分子识别层悬臂的至少一个表面，以便与目标生物聚合物相互作用。使用单片PZT悬臂可以在不使用额外的外部致动器的情况下将致动和感测应用于悬臂，使得悬臂传感器的尺寸可以显着减小并且耦合到精细的流体传输系统以测量非常少量的生物聚合物。

Figure 1