Complete sequence-based pathway analysis by differential on-chip DNA and RNA extraction from a single cell

General information
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Organisations: Department of Micro- and Nanotechnology, Optofluidics, Philips Research Laboratories, Philips Biocell, Fasteris SA, XGenomes
Authors: van Strijp, D. (Ekstern), Vuldres, R. C. M. (Ekstern), Larsen, N. (Ekstern), Schira, J. (Ekstern), Baerlocher, L. (Ekstern), van Driel, M. A. (Ekstern), Jensen, M. P. (Intern), Hansen, T. S. (Ekstern), Kristensen, A. (Intern), Mir, K. U. (Ekstern), Olesen, T. (Ekstern), Verhaegh, W. F. J. (Ekstern), Marie, R. (Intern), van der Zaag, P. J. (Ekstern)
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Scopus rating (2014): SJR 2.103 SNIP 1.544 CiteScore 4.75
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Web of Science (2012): Indexed yes
Direct bonding of ALD Al₂O₃ to silicon nitride thin films

Direct bonding is an advanced joining technique for bonding of silicon based surfaces at low temperature without any specific surface pretreatment. The main purpose of this work is to develop new techniques to enhance the fabrication process for nanofluidic systems for in situ transmission electron microscopy (TEM) by improving low temperature annealing bonding strength when using atomic layer deposition of aluminum oxide. We have investigated and characterized bonding of Al₂O₃-Si₅N₅ (low stress silicon rich nitride) and Al₂O₃-Si₃N₄ (stoichiometric nitride) thin films annealed from room temperature up to 600 degrees C without pretreatment prior to the pre bonding. We find that bonding of Al₂O₃-Si₅N₅ and Al₂O₃-Si₃N₄ is favorable in a temperature range from room temperature to 600 °C. We report bonding strength of 1300±150 mJ/m² comparable to and in some case even higher than that of other materials Al₂O₃ can be bonded to. Preliminary tests demonstrating a well-defined nanochannel system with-100 nm high channels successfully bonded and tests against leaks using optical fluorescence technique and transmission electron microscopy (TEM) characterization of liquid samples are also reported. Moreover, the current bonding method can be also used for further MEMS applications.

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, Molecular Windows, Optofluidics, Experimental Surface and Nanomaterials Physics, Silicon Microtechnology, Technical University of Denmark
Authors: Laganà, S. (Intern), Mikkelsen, E. K. (Ekstern), Marie, R. (Intern), Hansen, O. (Intern), Mølhave, K. (Intern)
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Scopus rating (2013): SJR 0.602 SNIP 1.001 CiteScore 1.45
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.745 SNIP 0.983 CiteScore 1.44
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
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Optical and hydrodynamic stretching of single cells from blood

Mechanical properties, like deformability or elasticity, of cells can in some cases be indicative of the health of the organism they originate from. In this work, we explore the potential of deformability and other mechanical parameters of individual red blood cells (RBCs) from humans as a marker for the state of health of the human source, patient or donor. In particular, we have investigated the use of different experimental strategies implemented in injection molded plastic microfluidic devices. One strategy is to optically stretch the red blood cells in an optical two-beam trap, also known as an optical stretcher, in a microfluidic chip in which optical fibers have been placed during a post-processing step. Another strategy is to exert hydrodynamic shear forces on the cells by forcing the cells through a narrow constriction. The latter method has the advantage of a considerably higher throughput but does so far not allow for subsequent investigations of single "interesting" cells. The paper is a progress report with preliminary results based on the different strategies, we have pursued.
Optothermally actuated capillary burst valve

We demonstrate the optothermal actuation of individual capillary burst valves in an all-polymer microfluidic device. The capillary burst valves are realised in a planar design by introducing a fluidic constriction in a microfluidic channel of constant depth. We show that a capillary burst valve can be burst by raising the temperature due to the temperature dependence of the fluid surface tension. We address individual valves by using a local heating platform based on a thin film of near infrared absorber dye embedded in the lid used to seal the microfluidic device [L. H. Thamdrup et al., Nano Lett. 10, 826–832 (2010)]. An individual valve is burst by focusing the laser in its vicinity. We demonstrate the capture of single polystyrene 7 m beads in the constriction triggered by the bursting of the valve.

Optothermally actuated capillary burst valve

We demonstrate the optothermal actuation of individual capillary burst valves in an all-polymer microfluidic device. The capillary burst valves are realised in a planar design by introducing a fluidic constriction in a microfluidic channel of constant depth. We show that a capillary burst valve can be burst by raising the temperature due to the temperature dependence of the fluid surface tension. We address individual valves by using a local heating platform based on a thin film of near infrared absorber dye embedded in the lid used to seal the microfluidic device [L. H. Thamdrup et al., Nano Lett. 10, 826–832 (2010)]. An individual valve is burst by focusing the laser in its vicinity. We demonstrate the capture of single polystyrene 7 m beads in the constriction triggered by the bursting of the valve.
Photothermal Transport of DNA in Entropy-Landscape Plasmonic Waveguides

The ability to handle single, free molecules in lab-on-a-chip systems is key to the development of advanced biotechnologies. Entropic confinement offers passive control of polymers in nanofluidic systems by locally asserting a molecule’s number of available conformation states through structured landscapes. Separately, a range of plasmonic configurations have demonstrated active manipulation of nano-objects by harnessing concentrated electric fields. The integration of these two independent techniques promises a range of sophisticated and complementary functions to handle, for example, DNA, but numerous difficulties, in particular, conflicting requirements of channel size, have prevented progress. Here, we show that metallic V-groove waveguides, embedded in fluidic nanoslits, form entropic potentials that trap and guide DNA molecules over well-defined routes while simultaneously promoting photothermal transport of DNA through the losses of plasmonic modes. The propulsive forces, assisted by in-coupling to propagating channel plasmon polaritons, extend along the V-grooves with a directed motion up to ≈0.5 μm·mW⁻¹ away from the input beam and λ-DNA velocities reaching ≈0.2 μm·s⁻¹·mW⁻¹. The entropic trapping enables the V-grooves to be flexibly loaded and unloaded with DNA by variation of transverse fluid flow, a process that is selective to biopolymers versus fixed-shape objects and also allows the technique to address the challenges of nanoscale interaction volumes. Our self-aligning, light-driven actuator provides a convenient platform to filter, route, and manipulate individual molecules and may be realized wholly by wafer-scale fabrication suitable for parallelized investigation.

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, Nanoprobes, Department of Physics, Experimental Surface and Nanomaterials Physics, Center for Nanostructured Graphene, Stochastic Systems and Signals, Optofluidics, Technical University of Denmark
Number of pages: 11
How to determine local stretching and tension in a flow-stretched DNA molecule

We determine the nonuniform stretching of and tension in a mega base pairs-long fragment of deoxyribonucleic acid (DNA) that is flow stretched in a nanofluidic chip. We use no markers, do not know the contour length of the DNA, and do not have the full DNA molecule inside our field of view. Instead, we analyze the transverse thermal motion of the DNA. Tension at the center of the DNA adds up to 16 pN, giving almost fully stretched DNA. This method was devised for optical mapping of DNA, specifically, DNA denaturation patterns. It may be useful also for other studies, e.g., DNA-protein interactions, specifically, their tension dependence. Generally, wherever long strands of DNA—e.g., native DNA extracted from human cells or bacteria—must be stretched with ease for inspection, this method applies.
New technologies for DNA analysis: a review of the READNA Project

The REvolutionary Approaches and Devices for Nucleic Acid analysis (READNA) project received funding from the European Commission for 4 1/2 years. The objectives of the project revolved around technological developments in nucleic acid analysis. The project partners have discovered, created and developed a huge body of insights into nucleic acid analysis, ranging from improvements and implementation of current technologies to the most promising sequencing technologies that constitute a 3rd and 4th generation of sequencing methods with nanopores and in situ sequencing, respectively.

General information

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Organisations: Department of Micro- and Nanotechnology, Optofluidics, Stochastic Systems and Signals, Centre National de Génotypage, University of Oxford, Comprehensive Biomarker Center GmbH, Damietta University, Clarendon Laboratory, Uppsala University, Christian Albrechts University, Olink AB, University of Leicester, Uppsala University, Universitat Pompeu Fabra, Stockholm University, Max Planck Institute for Molecular Genetics, FlexGen BV, CEA Saclay, Oxford Nanopore Technologies, Lund University, Philips Research, PHOTONIS France S.A.S., Thermo Fisher Scientific, Delft University of Technology, University of Southampton, University of Gothenburg


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Optical two-beam trap in a polymer microfluidic chip

An optical two-beam trap, composed from two counter propagating laser beams, is an interesting setup due to the ability of the system to trap, hold, and stretch soft biological objects like vesicles or single cells. Because of this functionality, the system was also named "the optical stretcher" by Jochen Guck, Josep Käs and co-workers some 15 years ago. In a favorable setup, the two opposing laser beams meet with equal intensities in the middle of a fluidic channel in which cells may flow past, be trapped, stretched, and allowed to move on, giving the promise of a high throughput device. Yet, single beam optical traps, aka optical tweezers, by far outnumber the existing optical stretchers in research labs throughout the world. The ability to easily construct an optical stretcher setup in a low-cost material would possibly imply more frequent use of the optical stretching technique. Here, we will outline the design, the production procedures, and results obtained in a fiber-based experimental setup built within an injection molded microfluidic polymer chip. The microfluidic chip is constructed with a three layer technology in which we ensure both horizontal and vertical focusing of the cells we wish to trap, thereby preventing too many cells to flow below the line of focus of the two counter propagating laser beams that are positioned perpendicular to the direction of flow of the cells. Results will be compared to that from other designs from previous work in the group.

General information

State: Published
Organisations: Department of Physics, Biophysics and Fluids, Department of Micro- and Nanotechnology, Optofluidics, Nanoprobes, NIL Technology ApS
Authors: Palanco, M. E. (Intern), Catak, D. (Intern), Marie, R. (Intern), Matteucci, M. (Intern), Bilenberg, B. (Ekstern), Kristensen, A. (Intern), Berg-Sørensen, K. (Intern)
Automation of a single-DNA molecule stretching device

We automate the manipulation of genomic-length DNA in a nanofluidic device based on real-time analysis of fluorescence images. In our protocol, individual molecules are picked from a microchannel and stretched with pN forces using pressure driven flows. The millimeter-long DNA fragments free flowing in micro- and nanofluidics emit low fluorescence and change shape, thus challenging the image analysis for machine vision. We demonstrate a set of image processing steps that increase the intrinsically low signal-to-noise ratio associated with single-molecule fluorescence microscopy. Furthermore, we demonstrate how to estimate the length of molecules by continuous real-time image stitching and how to increase the effective resolution of a pressure controller by pulse width modulation. The sequence of image-processing steps addresses the challenges of genomic-length DNA visualization; however, they should also be general to other applications of fluorescence-based microfluidics.

General information

State: Published
Organisations: Department of Micro- and Nanotechnology, Optofluidics, University of Copenhagen
Authors: Sørensen, K. T. (Intern), Lopacinska, J. M. (Ekstern), Tommerup, N. (Ekstern), Silahtaroglu, A. (Ekstern), Kristensen, A. (Intern), Marie, R. (Intern)
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Scopus rating (2014): SJR 0.922 SNIP 1.211 CiteScore 1.45
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.898 SNIP 1.117 CiteScore 1.28
Microfluidics for single cell analysis
Isolation and manipulation of single cells have gained an increasing interest from researchers because of the heterogeneity of cells from the same cell culture. Single cell analysis can ensure a better understanding of differences between individual cells and potentially solve a variety of clinical problems. In this thesis lab on a chip systems for rare single cell analysis are investigated. The focus was to develop a commercial, disposable device for circulating tumour cell (CTC) analysis. Such a device must be able to separate rare cells from blood samples and subsequently capture the specific cells, and simultaneously be fabricated and operated at low costs and be user-friendly. These challenges were addressed through development of two microfluidic devices, one for rare cell isolation based on pinched flow fractionation (PFF) and one for single cell capture based on hydrodynamic trapping. Both devices were fabricated by injection moulding...
with a nickel master.

CTC isolation was realised using PFF, which is a passive, size-based microfluidic technique. The focus was mainly on experimental work; however designs were based on flow calculations and analysed with numerical simulations to support experimental results. Devices were extensively characterised and tested with fluorescent nano- and microspheres, and with cancer cells and blood cell samples. It was demonstrated that the separation not only relies on size, but that differences in cell deformability are also exploited, which enabled a successful separation with an efficiency of over 90%.

Single cell capture was realised using hydrodynamic cell trapping, which is based on flow and cell interactions with microstructures. The criteria for hydrodynamic single cell capture were investigated and clarified through development of several devices with increasingly optimized designs. The final design provides the possibility of parallel single cell DNA extraction for subsequent off-chip investigations. Because the devices are sensitive to small changes of the structures, the injection moulding process was optimized to improve replication of the structures from the nickel master.

A novel method based on freeze-fracture was used to investigate and improve the bonding process used for sealing device microchannels. Structures were intentionally altered by bonding at high temperatures, and the resulting channel cross sections were visualized in a scanning electron microscope. It was demonstrated that chips with the altered structures had an increased capture efficiency.

Finally low cost mass-production of the devices was realised using injection moulding in thermoplastics from a nickel master. With this process the price per device rapidly decreases for higher numbers of fabricated devices. In addition devices were fabricated on a Luer-platform that ensures easy connection to external equipment. The devices were used by collaborators in a cancer research lab, which demonstrates their commercial potential.
Separation of cancer cells from white blood cells by pinched flow fractionation

In this paper, the microfluidic size-separation technique pinched flow fractionation (PFF) is used to separate cancer cells from white blood cells (WBCs). The cells are separated at efficiencies above 90% for both cell types. Circulating tumor cells (CTCs) are found in the blood of cancer patients and can form new tumors. CTCs are rare cells in blood, but they are important for the understanding of metastasis. There is therefore a high interest in developing a method for the enrichment of CTCs from blood samples, which also enables further analysis of the separated cells. The separation is challenged by the size overlap between cancer cells and the 106 times more abundant WBCs. The size overlap prevents high efficiency separation, however we demonstrate that cell deformability can be exploited in PFF devices to gain higher efficiencies than expected from the size distribution of the cells.

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Organisations: Department of Micro- and Nanotechnology, Optofluidics, John Radcliffe Hospital, Genotype2Phenotype LLC, NIL Technology ApS
Authors: Jensen, M. P. (Intern), Ashley, N. (Ekstern), Koprowska, K. (Ekstern), Mir, K. U. (Ekstern), Zalkovskij, M. (Ekstern), Blisenberg, B. (Ekstern), Bodmer, W. (Ekstern), Kristensen, A. (Intern), Marie, R. (Intern)
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  Web of Science (2016): Indexed yes
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  Web of Science (2015): Indexed yes
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  Scopus rating (2014): SJR 2.534 SNIP 1.801 CiteScore 5.6
  Web of Science (2014): Indexed yes
  BFI (2013): BFI-level 2
  Scopus rating (2013): SJR 2.374 SNIP 1.703 CiteScore 5.9
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  BFI (2012): BFI-level 2
  Scopus rating (2012): SJR 2.382 SNIP 1.738 CiteScore 5.35
  ISI indexed (2012): ISI indexed yes
  Web of Science (2012): Indexed yes
  BFI (2011): BFI-level 2
  Scopus rating (2011): SJR 2.535 SNIP 1.791 CiteScore 5.76
  ISI indexed (2011): ISI indexed yes
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  Scopus rating (2010): SJR 2.64 SNIP 1.846
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  Scopus rating (2009): SJR 2.575 SNIP 2.115
A microfluidic device with a diffusion barrier
The invention provides a microfluidic device for macromolecule amplification by sequential addition of liquid reagents. The device of the invention comprises a chip forming a plurality of reaction chambers each extending between an inlet and an outlet, each inlet being in fluid communication with a common junction via micro channels. To enable amplification of DNA, e.g. by MDA, the device comprises a diffusion barrier at each inlet configured to increase the pressure threshold for a reagent to cross the resistor. The invention further provides a method of mixing liquid reagents by use of the device where single DNA molecules are allowed to cross the diffusion barrier individually.

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A microfluidic device with pillars
The invention provides a microfluidic device for mixing liquid reagents, the device comprises, a chip forming at least one reaction chamber between a bottom and a top and extending between an inlet and an outlet. To enable manufacturing from less rigid materials, the device comprises pillars extending from the bottom to the top. The invention further provides a method of mixing reagents by use of the device.
Development and production of Lab-on-Chip systems for DNA mapping

During the last two decades, there has been a significant increase in the academic work in Lab on a Chip systems, while the number of commercial products has only increased a little. Many universities have research groups working within the field of Lab on a Chip and Micro Total Analysis Systems, and much funding has gone into the development of systems capable of performing a variety of different tasks. Meanwhile the industry has not seen the same potential in Lab on a Chip systems as the academic societies, resulting in knowledge being kept in the universities and not helping the population at large.

To try and overcome this situation, this thesis demonstrates a fabrication platform with the potential of producing thousands of identical polymer Lab on a Chip systems, containing structures in the length scale from 100nm to 50 μm on the same device and with a price that drops significantly as more devices are fabricated.

Such systems can be created, at the department, with a throughput of 25 devices per hour, and with a potential price as low as DKK 17.-

During the process, efforts were taken in developing a bonding scheme capable of giving a high yield on structures having aspect ratios as low as 1:200.

The developed polymer systems are tested by conducting two different experiments on DNA. Since such experiments are highly sensitive, efforts have been taken in order to lower the autofluorescence of the devices, resulting in a decrease of the background signal to roughly half the initial value.

The first experiment concerns mapping of short strands of λ-DNA and T4GT7-DNA against a theoretically obtained signal while stretched out in nanochannel confinements. The DNA is initially counterstained with a molecule that binds specifically to certain parts of the DNA. This counterstaining affects the staining with a fluorescent dye which, as a result of the first molecule, will distribute itself in a predictable, sequence specific, configuration along the DNA, thereby creating a fluorescent profile.

The nanochannels stretches the DNA to around 25% of their contour length and since several nanochannels can be placed parallel to each other, a large number of DNA molecules can be investigated.

In the second experiment, mapping is performed on human DNA in nanoslit devices. A fluorescent profile is created by heating the sample up to a temperature, where the DNA is partially denatured. The fluorescent dye will diffuse away from the denatured regions, and by analysing these black areas, the DNA molecule can be identified and potential mutations can be found.

In the nanoslits, the DNA is stretched out via a shear flow, resulting in a stretching of more than 95% of the contour length meaning a higher resolution compared to what was found when using the nanochannels.
Efficient Excitation of Channel Plasmons in Tailored, UV-Lithography-Defined V-Grooves

We demonstrate the highly efficient (>50%) conversion of freely propagating light to channel plasmon-polaritons (CPPs) in gold V-groove waveguides using compact 1.6 μm long waveguide-termination coupling mirrors. Our straightforward fabrication process, involving UV-lithography and crystallographic silicon etching, forms the coupling mirrors innately and ensures exceptional-quality, wafer-scale device production. We tailor the V-shaped profiles by thermal silicon oxidation in order to shift initially wedge-located modes downward into the V-grooves, resulting in well-confined CPPs suitable for nanophotonic applications.

High Excitation Efficiency of Channel Plasmon Polaritons in Tailored, UV-Lithography-Defined V-Grooves

We demonstrate >50% conversion of light to V-groove channel plasmon-polaritons (CPPs) via compact waveguide-termination mirrors. Devices are fabricated using UV-lithography and crystallographic silicon etching. The V-shape is tailored by thermal oxidation to support confined CPPs.
Injection molded microfluidic device for enrichment of somatic cells in cow milk

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Organisations: Department of Micro- and Nanotechnology, Optofluidics, Center for Nanostructured Graphene, BioLabChip, Unisensor A/S
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Injection molded pinched flow fractionation device for enrichment of somatic cells in cow milk

In this paper the continuous microfluidic separation technique pinched flow fractionation is applied to the enrichment of somatic cells from cow milk. Somatic cells were separated from the smallest fat particles and proteins thus better imaging and analysis of the cells can be achieved. The enrichment was performed using an all-polymer pinched flow fractionation device fabricated by injection molding. The polymer chips were bonded to a 500 lm polymer foil using UV assisted thermal bonding. The quality of the final devices was reproducible and the injection molding process combined with the use of cheap materials ensures the possibility for device mass production

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Nanofluidics to Enhance Single Molecule DNA Imaging: Detecting Genomic Structural Variation in Humans

General information
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Thermophoretic forces on DNA measured with a single-molecule spring balance

We stretch a single DNA molecule with thermophoretic forces and measure these forces with a spring balance: the DNA molecule itself. It is an entropic spring which we calibrate, using as a benchmark its Brownian motion in the nanochannel that contains and prestretches it. This direct measurement of the thermophoretic force in a static configuration finds forces up to 130 fN. This is eleven times stronger than the force experienced by the same molecule in the same thermal gradient in bulk, where the molecule shields itself. Our stronger forces stretch the middle of the molecule up to 80% of its contour length. We find the Soret coefficient per unit length of DNA at various ionic strengths. It agrees, with novel precision, with results obtained in bulk for DNA too short to shield itself and with the thermodynamic model of thermophoresis.

General information
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Organisations: Department of Micro- and Nanotechnology, Stochastic Systems and Signals, Optofluidics
Authors: Pedersen, J. N. (Intern), Lüscher, C. J. (Intern), Marie, R. (Intern), Thamdrup, L. H. (Intern), Kristensen, A. (Intern), Flyvbjerg, H. (Intern)
Number of pages: 5
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Web of Science (2016): Indexed yes
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Scopus rating (2015): SJR 3.823 SNIP 2.205 CiteScore 5.76
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 5.027 SNIP 2.646 CiteScore 6.62
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 5.674 SNIP 2.796 CiteScore 7.46
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
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A nanofluidic device for mapping single DNA molecules to the human genome

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Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2014

Fully Stretched Single DNA Molecules in a Nanofluidic Chip Show Large-Scale Structural Variation
When stretching and imaging DNA molecules in nanofluidic devices, it is important to know the relation between the physical length as measured in the lab and the distance along the contour of the DNA. Here a single DNA molecule longer than 1 Mbp is loaded into a nanofluidic device consisting of two crossing nanoslits (85nm x 50 microns) connected to microchannels. An applied pressure creates a stagnation point at the crossing of the nanoslits. The drag force from the fluid stretches the DNA. We determine the degree of stretching of the molecule (i) without the use of markers, (ii) without knowing the contour length of the DNA, and (iii) without having the full DNA molecule inside the field-of-view. The analysis is based on the transverse motion of the DNA due its Brownian motion, i.e. the DNA's response to the thermal fluctuations of the liquid surrounding it. The parameter values obtained by fitting agree well with values we obtain from simplified modeling of the DNA as a cylinder in a parallel flow. Secondly, DNA molecules stained with the intercalating dye YOYO-1 are de- and renatured locally following a modified version of the protocol used in Ref. 1. The result is a melting pattern which reflects the local AT/GC-content. Single molecules are loaded into the chip and imaged. Due to the almost complete stretching of the DNA, structural variations in the size range from kbp to Mbp can be detected and quantified from the melting pattern alone.

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, Stochastic Systems and Signals, Optofluidics, Silicon Microtechnology, University of Oxford
Pages: 175a
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Main Research Area: Technical/natural sciences

Publication information
Journal: Biophysical Journal
Volume: 104
Issue number: 2; SUPP/1
ISSN (Print): 0006-3495
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.06 SJR 1.946 SNIP 1.018
Injection moulded pinched flow fractionation device for cell separation

General information
State: Published
Injection moulded pinched flow fractionation device for cell separation

*General information*
State: Published
Organisations: Department of Micro- and Nanotechnology, Optofluidics, John Radcliffe Hospital, The Magdalen Centre
Authors: Jensen, M. P. (Intern), Ashley, N. (Ekstern), Bodmer, W. (Ekstern), Beckett, J. (Ekstern), Mir, K. (Ekstern), Marie, R. (Intern), Kristensen, A. (Intern)
Number of pages: 1
Publication date: 2013
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Poster – Annual report year: 2014

Integrated view of genome structure and sequence of a single DNA molecule in a nanofluidic device

We show how a bird’s-eye view of genomic structure can be obtained at ~1-kb resolution from long (~2 Mb) DNA molecules extracted from whole chromosomes in a nanofluidic laboratory-on-a-chip. We use an improved single-molecule denaturation mapping approach to detect repetitive elements and known as well as unique structural variation. Following its mapping, a molecule of interest was rescued from the chip; amplified and localized to a chromosome by FISH; and interrogated down to 1-bp resolution with a commercial sequencer, thereby reconciling haplotype-phased chromosome substructure with sequence.

*General information*
State: Published
Organisations: Department of Micro- and Nanotechnology, Optofluidics, Stochastic Systems and Signals, Silicon Microtechnology, University of Oxford
Pages: 4893-4898
Publication date: 2013
Main Research Area: Technical/natural sciences
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Volume: 110
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BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 8.56 SJR 6.321 SNIP 2.629
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 6.767 SNIP 2.682 CiteScore 8.84
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 6.853 SNIP 2.725 CiteScore 8.86
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 6.989 SNIP 2.73 CiteScore 9.5
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 6.792 SNIP 2.682 CiteScore 9.49
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 6.771 SNIP 2.636 CiteScore 9.31
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 6.769 SNIP 2.529
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 6.913 SNIP 2.544
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 6.899 SNIP 2.445
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 6.766 SNIP 2.441
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 6.734 SNIP 2.434
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 6.784 SNIP 2.551
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 7.026 SNIP 2.622
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 7.018 SNIP 2.501
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 7.183 SNIP 2.471
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 7.192 SNIP 2.463
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 7.731 SNIP 2.475
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 8.271 SNIP 2.446
Original language: English
Physical Sciences, Biological Sciences, Applied Physical Sciences, Genetics
DOIs:
10.1073/pnas.1214570110

Relations
Projects:
Integrated view of genome structure and sequence of a single DNA molecule in a nanofluidic device
Source: dtu
Source-ID: u::7270
Publication: Research - peer-review › Journal article – Annual report year: 2013
Passive Lab-in-a-Foil Devices for Phaseguiding and Multiple Displacement Amplification of DNA

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, Optofluidics, Fasteris SA
Authors: Eriksen, J. (Intern), Marie, R. (Intern), Schira, J. (Ekstern), Vincent, N. (Ekstern), Kristensen, A. (Intern)
Number of pages: 2
Publication date: 2013

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Title of host publication: Proceedings of NanoBioTech - Montreux 2013
Main Research Area: Technical/natural sciences
Electronic versions:
Nanobiotech_Montreux_final_fasteris.pdf
Source: dtu
Source-ID: u::10910
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2014

Tailoring channeled plasmon polaritons in metallic V-grooves
Channeled plasmon polaritons (CPPs) are electromagnetic excitations that are bound to and propagate along metallic V-groove waveguides [1]. CPPs offer subwavelength lateral confinement, an ability to turn sharp bends with near-zero loss and are considered to be one of the most suitable forms of propagating plasmons to optimize the trade-off between lateral confinement and loss [2]. Accordingly, the traits of CPPs in metallic V-grooves suggest their widespread implementation, with applications ranging from ultracompact photonic circuitry [3] to lab-on-a-chip sensing. Current CPP research focuses on the optimization of their properties (e.g. propagation length, confinement) and improving both the quality and cost of fabrication techniques [4]. © 2013 IEEE.

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, Optofluidics, Nanoprobes
Authors: Smith, C. (Intern), Thilsted, A. H. (Intern), Marie, R. (Intern), Vannahme, C. (Intern), Kristensen, A. (Intern)
Number of pages: 1
Publication date: 2013

Host publication information
Title of host publication: Proceedings of 2013 Conference on and International Quantum Electronics Conference Lasers and Electro-Optics Europe (CLEO EUROPE/IQEC)
ISBN (Print): 978-1-4799-0593-5
Main Research Area: Technical/natural sciences
Electrical and Electronic Engineering, Optimization, Phonons, Photons, Plasmons, Quantum electronics, Solids, Electromagnetic excitations, Fabrication technique, Lateral confinement, Photonic circuitry, Plasmon-polaritons, Propagation lengths, Research focus, Sub-wavelength, Electron optics
DOIs:
10.1109/cleoe-iqec.2013.6801933
Source: FindIt
Source-ID: 2198952945
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2013

Visualizing structural variations of single DNA molecules in a nanofluidic device

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, Optofluidics, Stochastic Systems and Signals, Wellcome Trust Centre for Human Genetics
Number of pages: 1
Publication date: 2013
Event: Abstract from DNA in nanotechnology, Gothenburg, Sweden.
Main Research Area: Technical/natural sciences
All polymer, injection molded nanoslits, fabricated through two-level UV-LIGA processes

Micro- and nanofluidic systems fabricated in silicon and glass substrates are expensive and have long production cycles. To minimize the time used by researchers to fabricate their systems, rather than using them, medium to high volume throughput of specific chips, containing fluidic channels in the micro- and nanoregime is required. To obtain this, injection molding is included in the research process for making several chips (100-1000) with the same layout. The time it takes for the individual chip to be fabricated in this way is much shorter than with conventional cleanroom methods, and the price is equally lower. Optimization of the final chip is explored, by looking at which aspects ratios are possible to obtain in polymer chips. Finally, signal to noise ratio of the chips used for fluorescent experiments is investigated, by an expected reduction of the excitation of fluorescent states in the polymer with the use of chips in different colors.

DNA Catenation Maintains Structure of Human Metaphase Chromosomes

Mitotic chromosome structure is pivotal to cell division but difficult to observe in fine detail using conventional methods. DNA catenation has been implicated in both sister chromatid cohesion and chromosome condensation, but has never been observed directly. We have used a lab-on-a-chip microfluidic device and fluorescence microscopy, coupled with a simple image analysis pipeline, to digest chromosomal proteins and examine the structure of the remaining DNA, which maintains the canonical ‘X’ shape. By directly staining DNA, we observe that DNA catenation between sister chromatids
(separated by fluid flow) is composed of distinct fibres of DNA concentrated at the centromeres. Disrupting the catenation of the chromosomes with Topoisomerase IIa significantly alters overall chromosome shape, suggesting that DNA catenation must be simultaneously maintained for correct chromosome condensation, and destroyed to complete sister chromatid disjunction. In addition to demonstrating the value of microfluidics as a tool for examining chromosome structure, these results lend support to certain models of DNA catenation organization and regulation: in particular, we conclude from our observation of centromere-concentrated catenation that spindle forces could play a driving role in decatenation and that Topoisomerase IIa is differentially regulated at the centromeres, perhaps in conjunction with cohesin.

**General information**

State: Published
Organisations: Department of Micro- and Nanotechnology, Optofluidics, Silicon Microtechnology, University of Oxford
Authors: L. V. Bauer, D. (Ekstern), Marie, R. (Intern), Rasmussen, K. H. (Intern), Kristensen, A. (Intern), U. Mir, K. (Ekstern)
Pages: 11428-11434
Publication date: 2012
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Nucleic Acids Research
Volume: 40
Issue number: 22
ISSN (Print): 0305-1048
Ratings:
- BFI (2017): BFI-level 2
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 2
- Scopus rating (2016): CiteScore 9.28 SJR 7.397 SNIP 2.657
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 2
- Scopus rating (2015): SJR 7.239 SNIP 2.639 CiteScore 9.48
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 2
- Scopus rating (2014): SJR 6.576 SNIP 2.568 CiteScore 8.74
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 2
- Scopus rating (2013): SJR 6.582 SNIP 2.266 CiteScore 8.46
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 2
- Scopus rating (2012): SJR 6.13 SNIP 2.392 CiteScore 8.62
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 2
- Scopus rating (2011): SJR 5.758 SNIP 2.172 CiteScore 7.86
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 2
- Scopus rating (2010): SJR 5.24 SNIP 2.034
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 2
- Scopus rating (2009): SJR 5.571 SNIP 1.869
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 4.641 SNIP 1.557
- Web of Science (2008): Indexed yes
- Scopus rating (2007): SJR 4.86 SNIP 1.787
- Web of Science (2007): Indexed yes
- Scopus rating (2006): SJR 4.55 SNIP 2.04
Fabrication of combined-scale nano- and microfluidic polymer systems using a multilevel dry etching, electroplating and molding process

Microfabricated single-cell capture and DNA stretching devices have been produced by injection molding. The fabrication scheme employed deep reactive ion etching in a silicon substrate, electroplating in nickel and molding in cyclic olefin polymer. This work proposes technical solutions to fabrication challenges associated with chip sealing and demolding of polymer high-volume replication methods. UV-assisted thermal bonding was found to ensure a strong seal of the microstructures in the molded part without altering the geometry of the channels. In the DNA stretching device, a low aspect ratio nanoslit (1/200) connecting two larger micro-channels was used to stretch a 168.5 kbp DNA molecule, while in the other device single-HeLa cells were captured against a micro-aperture connecting two larger microfluidic channels. Different dry etching processes have been investigated for the master origination of the cell-capture device. The combination of a modified Bosch process and an isotropic polysilicon etch was found to ensure the ease of demolding by resulting in slightly positively tapered sidewalls with negligible undercut at the mask interface.

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, Polymer Micro & Nano Engineering, Optofluidics, MEMS-AppliedSensors
Authors: Tanzi, S. (Intern), Østergaard, P. F. (Intern), Matteucci, M. (Intern), Christiansen, T. L. (Intern), Cech, J. (Intern), Marie, R. (Intern), Taboryski, R. J. (Intern)
Number of pages: 11
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Micromechanics and Microengineering
Volume: 22
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Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.74 SJR 0.595 SNIP 1.017
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.64 SNIP 1.211 CiteScore 1.96
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.725 SNIP 1.224 CiteScore 1.84
Web of Science (2014): Indexed yes
Fabrication of Low Aspect Ratio, Injection Molded Structures for Use in dsDNA Elongation

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, Polymer Micro & Nano Engineering, Optofluidics
Authors: Østergaard, P. F. (Intern), Matteucci, M. (Intern), Marie, R. (Intern), Kristensen, A. (Intern), Taboryski, R. J. (Intern)
Number of pages: 1
Publication date: 2012
Main Research Area: Technical/natural sciences
Source: dtu
Source-ID: u::5071
Original language: English
**Microfluidic device and method for processing of macromolecules**

A microfluidic device and method for enzymatic processing of ultra-long macromolecules is disclosed. The device comprises a reaction chamber with a first manifold, a second manifold, and a plurality of reaction channels, each reaction channel extending from the first manifold to the second manifold. The device further comprises first inlet and outlet channels for filling the reaction channels via the manifolds with one or more macromolecule containers suspended in a first carrier fluid, wherein the first inlet and outlet channels are configured such that a flow established from the first set of inlets to the first set of outlets is guided through the reaction channels, and second inlet and outlet channels for feeding an enzymatic reagent to the reaction chamber essentially without displacing the macromolecule containers trapped in the reaction channels, wherein the second set of inlets and outlets are configured such that a flow established from the second inlet to the second outlet is guided through at least one of the manifolds and bypasses the reaction channels.

**General information**

State: Published  
Organisations: Department of Micro- and Nanotechnology, Optofluidics, Silicon Microtechnology  
Authors: Kristensen, A. (Intern), Marie, R. (Intern), Rasmussen, K. H. (Intern), Kalim Ullah, M. (Ekstern)  
Publication date: 2012

**Publication Information**

Country: Denmark  
IPC: B01L3/00  
Patent number: WO2012055415  
Date: 03/05/2012  
Original language: English

**Bibliographical note**

DTU reference number: 92542-10  
Main Research Area: Technical/natural sciences  
Publication: Research › Patent – Annual report year: 2012

**Nanofluidic devices towards single DNA molecule sequence mapping**

**General information**

State: Published  
Organisations: Department of Micro- and Nanotechnology, Optofluidics  
Authors: Marie, R. (Intern), Kristensen, A. (Intern)  
Pages: 673  
Publication date: 2012  
Main Research Area: Technical/natural sciences

**Publication Information**

Journal: Journal of Biophotonics  
Volume: 5  
Issue number: 9-9  
ISSN (Print): 1864-063X  
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BFI (2017): BFI-level 1  
Web of Science (2017): Indexed Yes  
BFI (2016): BFI-level 1  
Scopus rating (2016): CiteScore 3.72 SJR 1.113 SNIP 1.243  
BFI (2015): BFI-level 1  
Scopus rating (2015): SJR 1.087 SNIP 1.22 CiteScore 3.23  
BFI (2014): BFI-level 1  
Scopus rating (2014): SJR 1 SNIP 1.233 CiteScore 3.13  
BFI (2013): BFI-level 1  
Scopus rating (2013): SJR 1.116 SNIP 1.394 CiteScore 3.38  
ISI indexed (2013): ISI indexed yes  
Web of Science (2013): Indexed yes  
BFI (2012): BFI-level 1  
Scopus rating (2012): SJR 1.058 SNIP 1.376 CiteScore 2.88
Sub-wavelength surface gratings for light redirection in transparent substrates

We demonstrate sub-wavelength grating couplers patterned on glass surfaces which are designed to convert incident free-space radiation into guided modes along the glass material. The devices are fabricated by nanoimprint lithography and the measured optical performance is compared to a simple model based on diffraction and ray-optics, and complemented by numerical simulations. We show that our approach is suitable for redirecting and guiding light over a broad range of incident angles and wavelengths in transparent substrates. The technique has potential applications for solar harvesting in window panes and display applications with minimal influence on vision quality. (C) 2012 American Institute of Physics. [http://dx.doi.org/10.1063/1.4738777]
A device for extraction, manipulation and stretching of DNA from single human chromosomes

We describe the structure and operation of a micro/nanofluidic device in which individual metaphase chromosomes can be isolated and processed without being displaced during exchange of reagents. The change in chromosome morphology as a result of introducing protease into the device was observed by time-lapse imaging; pressure-driven flow was then used to shunt the chromosomal DNA package into a nanoslit. A long linear DNA strand (>1.3 Mbp) was seen to stretch out from the DNA package and along the length of the nanoslit. Delivery of DNA in its native metaphase chromosome package as well as the microfluidic environment prevented DNA from shearing and will be important for preparing ultra-long lengths of DNA for nanofluidic analysis.

General information
State: Published
Organisations: NSE-Optofluidics Group, NanoSystemsEngineering Section, Department of Micro- and Nanotechnology, Nano-Bio Integrated Systems Group, Biomedical Micro Systems Section, University of Oxford
Authors: Rasmussen, K. H. (Intern), Marie, R. (Intern), Moresco, J. L. (Intern), Svendsen, W. E. (Intern), Kristensen, A. (Intern), Mir, K. U. (Ekstern)
All-silica nanofluidic devices for DNA-analysis fabricated by imprint of sol-gel silica with silicon stamp.

We present a simple and cheap method for fabrication of silica nanofluidic devices for single-molecule studies. By imprinting sol-gel materials with a multi-level stamp comprising micro- and nanofeatures, channels of different depth are produced in a single process step. Calcination of the imprinted hybrid sol-gel material produces purely inorganic silica, which has very low autofluorescence and can be fusion bonded to a glass lid. Compared to top-down processing of fused silica or silicon substrates, imprint of sol-gel silica enables fabrication of high-quality nanofluidic devices without expensive high-vacuum lithography and etching techniques. The applicability of the fabricated device for single-molecule studies is demonstrated by measuring the extension of DNA molecules of different lengths confined in the nanochannels.
Controlled deposition of sol–gel sensor material using hemiwickng

Optical sensors are fabricated by depositing liquid sol–gel sensor material on a polycarbonate surface, which has been decorated with arrays of periodic micropillars. Using the principle of hemiwickng, the liquid material is spread, guided by the surface structures, to homogeneously fill the volume between the surface structures and form a liquid film with a thickness determined by the height of the micropillars. After evaporation of solvents, a uniform layer of sensor material resides on the surface. This fabrication method enables easy and reproducible deposits of isolated spots of different sensor materials of precise thickness to be made on plastic surfaces, and it provides an improved method for fabricating cheap optical sensors integrated in disposable lab containers.

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, DELTA, Dublin City University
Authors: Mikkelsen, M. B. L. (Intern), Marie, R. (Intern), Hansen, J. H. (Ekstern), Wencel, D. (Ekstern), McDonagh, C. (Ekstern), Nielsen, H. O. (Ekstern), Kristensen, A. (Intern)
Pages: 115008
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Micromechanics and Microengineering
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Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.74 SJR 0.595 SNIP 1.017
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.64 SNIP 1.211 CiteScore 1.96
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.725 SNIP 1.224 CiteScore 1.84
Deposition of sol-gel sensor spots by nanoimprint lithography and hemi-wicking

We present a method for homogeneous deposition of sol-gel sensor materials, which enable fabrication of sensor spots for optical pH and oxygen measurements inside plastic containers. A periodic pattern of posts is imprinted into a polycarbonate substrate and, using the principle of hemi-wicking, a deposited droplet spreads, guided by the posts, to automatically fill the imprinted structure, not being sensitive to alignment as long as it is deposited inside the patterned area. Hemi-wicking is an effective method to immobilize a low viscosity liquid material in well-defined spots on a surface, when conventional methods such as screen- or stamp-printing do not work. On length scales of the order of the microstructure period, surface tension will govern the shape of the liquid-air interface, and the liquid will climb up the pillars.
to keep a fixed contact angle with the sidewalls. The surface to volume ratio is therefore constant all over the surface of the liquid spread by hemi-wicking, when considering length scales larger than the microstructure period. Material redistribution caused by solvent evaporation, i.e., the "coffee ring effect", can therefore be avoided because the evaporation rate does not vary on length scales larger than the periodic pattern.

**General information**

**State:** Published

**Organisations:** Department of Micro- and Nanotechnology, DELTA

**Authors:** Mikkelsen, M. B. L. (Intern), Marie, R. (Intern), Hansen, J. H. (Ekstern), Nielsen, H. O. (Ekstern), Kristensen, A. (Intern)

**Pages:** 81020N

**Publication date:** 2011

**Conference:** Nanoengineering: Fabrication, Properties, Optics, and Devices VIII, USA, San Diego, CA, 23 Aug, 01/01/2011

**Main Research Area:** Technical/natural sciences

**Publication information**

**Journal:** Proceedings of the SPIE - The International Society for Optical Engineering

**Volume:** 8102

**ISSN (Print):** 0277-786X

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BFI (2017): BFI-level 1

BFI (2016): BFI-level 1

Scopus rating (2016): CiteScore 0.42 SNIP 0.245

Web of Science (2016): Indexed yes

BFI (2015): BFI-level 1

Scopus rating (2015): SJR 0.187 SNIP 0.224 CiteScore 0.3

BFI (2014): BFI-level 1

Scopus rating (2014): SJR 0.188 SNIP 0.231 CiteScore 0.3

BFI (2013): BFI-level 1

Scopus rating (2013): SJR 0.2 SNIP 0.259 CiteScore 0.26

ISI indexed (2013): ISI indexed no

Web of Science (2013): Indexed yes

BFI (2012): BFI-level 1

Scopus rating (2012): SJR 0.194 SNIP 0.243 CiteScore 0.27

ISI indexed (2012): ISI indexed no

Web of Science (2012): Indexed yes

BFI (2011): BFI-level 1

Scopus rating (2011): SJR 0.197 SNIP 0.264 CiteScore 0.31

ISI indexed (2011): ISI indexed no

BFI (2010): BFI-level 1

Scopus rating (2010): SJR 0.208 SNIP 0.241

Web of Science (2010): Indexed yes

BFI (2009): BFI-level 1

Scopus rating (2009): SJR 0.211 SNIP 0.271

BFI (2008): BFI-level 1

Scopus rating (2008): SJR 0.222 SNIP 0.289

Web of Science (2008): Indexed yes

Scopus rating (2007): SJR 0.227 SNIP 0.37

Web of Science (2007): Indexed yes

Scopus rating (2006): SJR 0.308 SNIP 0.701

Scopus rating (2005): SJR 0.158 SNIP 0.343

Web of Science (2004): Indexed yes

Web of Science (2002): Indexed yes

**Original language:** English

**Optical Sensor, Nanoimprint, Hemi-Wicking, Sol-Gel**

**DOIs:**

10.1117/12.893139
DNA analysis by single molecule stretching in nanofluidic biochips

Stretching single DNA molecules by confinement in nanofluidic channels has attracted a great interest during the last few years as a DNA analysis tool. We have designed and fabricated a sealed micro/nanofluidic device for DNA stretching applications, based on the use of the high throughput Nanolimit Lithography (NIL) technology combined with a conventional anodic bonding of the silicon base and Pyrex cover. Using this chip, we have performed single molecule imaging on a bench-top fluorescent microscope system. Lambda phage DNA was used as a model sample to characterize the chip. Single molecules of λ-DNA stained with the fluorescent dye YOYO-1 were stretched in the nanochannel array and the experimental results were analysed to determine the extension factor of the DNA in the chip and the geometrical average of the nanochannel inner diameter. The determination of the extension ratio of the chip provides a method to determining DNA size. The results of this work prove that the developed fabrication process is a good alternative for the fabrication of single molecule DNA biochips and it allows developing a variety of innovative bio/chemical sensors based on single-molecule DNA sequencing devices.

General information
State: Published
Organisations: NSE-Optofluidics Group, NanoSystemsEngineering Section, Department of Micro- and Nanotechnology, Fundacion Tekniker
Authors: Abad, E. (Ekstern), Juanros, A. (Ekstern), Retolaza, A. (Ekstern), Merino, S. (Ekstern), Marie, R. (Intern), Kristensen, A. (Intern)
Pages: 300-304
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: Microelectronic Engineering
Volume: 88
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ISSN (Print): 0167-9317
Ratings:
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.69 SJR 0.606 SNIP 0.999
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.533 SNIP 0.856 CiteScore 1.35
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.592 SNIP 0.897 CiteScore 1.44
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.602 SNIP 1.001 CiteScore 1.45
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.745 SNIP 0.983 CiteScore 1.44
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.818 SNIP 1.169 CiteScore 1.8
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.946 SNIP 1.119
Web of Science (2010): Indexed yes
Dynamic in situ chromosome immobilisation and DNA extraction using localized poly(N-isopropylacrylamide) phase transition

A method of in situ chromosome immobilisation and DNA extraction in a microfluidic polymer chip was presented. Light-induced local heating was used to induce poly(N-isopropylacrylamide) phase transition in order to create a hydrogel and embed a single chromosome such that it was immobilised. This was achieved with the use of a near-infrared laser focused on an absorption layer integrated in the polymer chip in close proximity to the microchannel. It was possible to proceed to DNA extraction while holding on the chromosome at an arbitrary location by introducing protease K into the microchannel.

© 2011 American Institute of Physics.
Method for depositing sensor material on a substrate

General information
State: Published
Organisations: Department of Micro- and Nanotechnology
Authors: Hansen, J. H. (Ekstern), Nielsen, H. O. (Ekstern), Kristensen, A. (Intern), Mikkelsen, M. B. L. (Intern), Marie, R. (Intern)
Publication date: 2011

Publication information
Patent number: WO 2011144652
Date: 24/11/2011
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 285641
Publication: Research - peer-review › Journal article – Annual report year: 2011

Solar energy harvesting system

General information
State: Published
Organisations: Department of Micro- and Nanotechnology
Authors: Marie, R. (Intern), Vig, A. L. (Intern), Christiansen, M. B. (Intern), Kristensen, A. (Intern)
Publication date: 2011

Publication information
Optofluidic microscope with 3D spatial resolution
This paper reports on-chip based optical detection with three-dimensional spatial resolution by integration of an optofluidic microscope (OFM) in a microfluidic pinched flow fractionation (PFF) separation device. This setup also enables on-chip particle image velocimetry (PIV). The position in the plane perpendicular to the flow direction and the velocity along the flow direction of separated fluorescent labeled polystyrene microspheres with diameters of 1μm, 2.1μm, 3μm and 4μm is determined by the OFM. These results are bench marked against those obtained with a PFF device using conventional fluorescence microscope readout. The size separated microspheres are detected by OFM with an accuracy of ≤0.92μm. The position in the height of the channel and the velocity of the separated microspheres are detected with an accuracy of 1.4μm and 0.08 mm/s respectively. Throughout the measurements of the height and velocity distribution, the microspheres are observed to move towards the center of the channel in regard to its height.

General information
State: Published
Organisations: NSE-Optofluidics Group, NanoSystemsEngineering Section, Department of Micro- and Nanotechnology
Authors: Vig, A. L. (Intern), Marie, R. (Intern), Jensen, E. (Intern), Kristensen, A. (Intern)
Pages: 4158-4169
Publication date: 2010
Main Research Area: Technical/natural sciences

Publication information
Journal: Optics Express
Volume: 18
Issue number: 5
ISSN (Print): 1094-4087
Ratings:
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.48 SJR 1.487 SNIP 1.589
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.976 SNIP 1.755 CiteScore 3.78
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.349 SNIP 2.166 CiteScore 4.18
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.358 SNIP 2.226 CiteScore 4.38
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.587 SNIP 2.145 CiteScore 3.85
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.579 SNIP 2.606 CiteScore 4.04
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.943 SNIP 2.466
Three-dimensional positioning with optofluidic microscope

This paper reports on-chip based optical detection with three-dimensional spatial resolution by integration of an optofluidic microscope (OFM) in a microfluidic pinched flow fractionation (PFF) separation device. This setup also enables on-chip particle image velocimetry (PIV). The position in the plane perpendicular to the flow direction and the velocity along the flow direction of separated fluorescent labeled polystyrene microspheres with diameters of 1 μm, 2.1 μm, 3 μm and 4 μm is measured using the OFM readout. These results are bench marked against those obtained with a PFF device using a conventional fluorescence microscope as readout. The size separated microspheres are detected by OFM with an accuracy of ≤ 0.92 μm. The position in the height of the channel and the velocity of the separated microspheres are detected with an accuracy of 1.4 μm and 0.08 mm/s respectively. Throughout the measurements of the height and velocity distribution, the microspheres are observed to move towards the center of the channel in regard to its height.

General information

State: Published
Organisations: Department of Micro- and Nanotechnology, NSE-Optofluidics Group, NanoSystemsEngineering Section
Authors: Vig, A. L. (Intern), Marie, R. (Intern), Jensen, E. (Intern), Kristensen, A. (Intern)
Pages: 77621X
Publication date: 2010
Conference: SPIE Optics and Photonics Annual Meeting, San Diego, CA, United States, 01/08/2010 - 01/08/2010
Main Research Area: Technical/natural sciences
Generic surface modification strategy for sensing applications based on Au/SiO2 nanostructures

A generic protocol for the creation of material-mediated self-assembled patterns of streptavidin, defined solely by patterns of gold and SiO2, is presented. Protein-adsorption resistance of selected regions was obtained by material-specific adsorption of thiol-modified polyethyleneglycol thiol-PEG on gold followed by adsorption of poly-L-lysine PLL modified PEG PLL-g-PEG on SiO2. Selective streptavidin binding to either gold or SiO2 or both was ensured by introducing biotin-modified thiolated thiol-biotin and/or biotin-modified PLL-g-PEG PLL-g-PEGbiotin compounds. The introduction of biotin did not influence the protein-adsorption resistance. On the macroscopic scale, the protein-adsorption-resistant properties and the streptavidin-binding capacity were optimized using quartz crystal microbalance with dissipation monitoring. The reproduction of micrometer-scale gold patterns on SiO2 into patterns of streptavidin was verified using fluorescence microscopy, while the compatibility of the material-specific surface-modification strategy with nanoscale features was accomplished by modifying a localized surface plasmon resonance LSPR active template, defined by randomly distributed nanoapertures in a thin gold film on SiO2. The demonstrated compatibility of the latter substrate with LSPR-based label-free sensing of biorecognition reactions, combined with the fact that all compounds utilized are commercially available,
makes the surface-modification protocol attractive as a generic surface modification solution for a broad range of 
biorecognition-based assays.

General information
State: Published
Organisations: Lund University
Authors: Marie, R. (Intern), Dahlin, A. B. (Ekstern), Tegenfeldt, J. O. (Ekstern), Hook, F. (Ekstern)
Pages: 49-55
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: Biointerphases
Volume: 2
Issue number: 1
ISSN (Print): 1934-8630
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes

Immobilisation of DNA to polymerised SU-8 photoresist

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, Bioprobes, Micro Array Technology
Pages: 1327-32
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: Biosensors and Bioelectronics
Volume: 21
Issue number: 7
ISSN (Print): 0956-5663
Ratings:
BFI (2017): BFI-level 1
Use of PLL-g-PEG in Micro-Fluidic Devices for Localizing Selective

General information
State: Published
Organisations: Lund University
Authors: Marie, R. (Intern)
Pages: 10103-10118
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: Langmuir
Volume: 22
Issue number: 24
ISSN (Print): 0743-7463
Ratings:
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.99 SJR 1.55 SNIP 1.188
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.686 SNIP 1.308 CiteScore 4.33
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.816 SNIP 1.391 CiteScore 4.59
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.895 SNIP 1.356 CiteScore 4.55
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.177 SNIP 1.382 CiteScore 4.37
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.051 SNIP 1.357 CiteScore 4.42
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.148 SNIP 1.4
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.156 SNIP 1.351
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 2.383 SNIP 1.34
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.449 SNIP 1.434
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.375 SNIP 1.428
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.157 SNIP 1.463
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.963 SNIP 1.458
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.953 SNIP 1.4
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.011 SNIP 1.489
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 2.01 SNIP 1.382
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 2.039 SNIP 1.479
Use of PLL-g-PEG in Micro-Fluidic Devices for Localizing Selective and Specific Protein Binding

By utilizing flow-controlled PLL-g-PEG and PLL-g-PEG-biotin modification of predefined regions of a poly(dimethylsiloxane) (PDMS) micro-fluidic device, with an intentionally chosen large (1 cm²) internal surface area, we report rapid (10 min), highly localized (6·10⁻⁶ cm²), and specific surface-based protein capture from a sample volume (100 µL) containing a low amount of protein (160 attomol in pure buffer and 400 attomol in serum). The design criteria for this surface modification were achieved using QCM-D (quartz crystal microbalance with energy dissipation monitoring) of serum protein adsorption onto PLL-g-PEG-modified oxidized PDMS. Equally good, or almost as good, results were obtained for oxidized SU-8, Topas, and poly(methyl metacrylate) (PMMA), demonstrating the generic potential of PLL-g-PEG for surface modification in various micro-fluidic applications.
Building a multi-walled carbon nanotube-based mass sensor with the atomic force microscope

General information
State: Published
Organisations: Department of Micro- and Nanotechnology
Authors: Mateiu, R. V. (Intern), Kuhle, A. (Ekstern), Marie, R. C. W. (Intern), Boisen, A. (Intern)
Pages: 233-237
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: Ultramicroscopy
Volume: 105
Issue number: 1-4
ISSN (Print): 0304-3991
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.82 SJR 1.915 SNIP 1.233
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.121 SNIP 1.428 CiteScore 2.78
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.638 SNIP 1.661 CiteScore 2.59
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.777 SNIP 1.337 CiteScore 2.66
Nanocantilever Sensitivity Degradation From Bimorph Effects

General information
State: Published
Organisations: Department of Micro- and Nanotechnology
Publication date: 2005

Host publication information
Title of host publication: Proceedings of NanotechInsight 2005
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 182360
Publication: Research - peer-review › Article in proceedings – Annual report year: 2005
Self-actuated Polymeric Valve for Autonomous Sensing and Mixing

We present an autonomously operated microvalve array for chemical sensing and mixing, which gains the actuation energy from a chemical reaction on the valve structure. An 8-μm-thick flapper valve made in SU-8 is coated with stress-loaded Al on one side and Ti on the other side. The metal films keep the flapper in a flat, stress-balanced closed position. Upon contact with an analyte composed of a NaOH solution the Al film is etched from the valve surface unbalancing the surface stress and bending the flapper. A deflection of up to 45 μm is observed allowing for effective release of a green marker from a reservoir. Calculations reveal that valve operation with stress originating from biochemical processes will require considerable enhancement of the actuation efficiency.

General information
State: Published
Organisations: Bioprobes, Department of Micro- and Nanotechnology
Authors: Häfliger, D. (Intern), Marie, R. C. W. (Intern), Boisen, A. (Intern)
Pages: 1569-1572
Publication date: 2005

Host publication information
Volume: 2
Publisher: IEEE
ISBN (Print): 0-7803-8994-8
Main Research Area: Technical/natural sciences
Conference: 13th International Conference on Solid-State Sensors, Actuators and Microsystems (Transducers '05), Seoul, Korea, Republic of, 01/01/2005
Electronic versions:
Haefliger.pdf
DOIs:
10.1109/SENSOR.2005.1497385

Bibliographical note
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Source: orbit
Source-ID: 186041
Publication: Research - peer-review › Article in proceedings – Annual report year: 2005

Nucleic acid reactions investigated by cantilever-based sensors

General information
State: Published
Organisations: NSE-Optofluidics Group, NanoSystemsEngineering Section, Department of Micro- and Nanotechnology, Nanoprobes Group
Authors: Marie, R. (Intern), Boisen, A. (Intern), Christensen, C. B. V. (Intern)
Publication date: May 2004

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Marie.pdf
Source: orbit
Source-ID: 61693
Publication: Research › Ph.D. thesis – Annual report year: 2004

A wet chemical treatment for specific change of the contact angle of SU-8

General information
State: Published
Organisations: Department of Micro- and Nanotechnology
Authors: Nordstrom, M. (Intern), Marie, R. C. W. (Intern), Gomez, M. (Intern), Boisen, A. (Intern)
Pages: 91-93
Publication date: 2004
DNA hybridization detected by cantilever-based sensor with integrated piezoresistive read-out

**General information**
State: Published
Organisations: Department of Micro- and Nanotechnology
Authors: Marie, R. C. W. (Intern), Christensen, C. B. V. (Intern), Boisen, A. (Intern)
Pages: 485-487
Publication date: 2004

Highly Ordered Oligonucleotide Domain formation on Au(111),
Book of Abstracts, 4.1.4 - Talk.

**General information**
State: Published
Organisations: Department of Chemistry, Department of Micro- and Nanotechnology
Authors: Wackerbarth, H. (Intern), Grubb, M. (Intern), Marie, R. C. W. (Intern), Boisen, A. (Intern), Ulstrup, J. (Intern)
Publication date: 2004
Event: Abstract from The Eighth World Congress on Biosensors., Granada, Spain, 24-26. May, .
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 159073
Publication: Research › Conference abstract for conference – Annual report year: 2004

Rendering SU-8 hydrophilic to facilitate use in micro channel fabrication

**General information**
State: Published
Organisations: Department of Micro- and Nanotechnology, NSE-Optofluidics Group, NanoSystemsEngineering Section, Nanoprobes Group
Authors: Nordström, M. (Ekstern), Marie, R. (Intern), Gomez, M. (Intern), Boisen, A. (Intern)
Pages: 1614-1617
Publication date: 2004
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Journal of Micromechanics and Microengineering
Volume: 14
Issue number: 12
ISSN (Print): 0960-1317
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.74 SJR 0.595 SNIP 1.017
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.64 SNIP 1.211 CiteScore 1.96
Web of Science (2015): Indexed yes
Self-Assembly of Sulfur Anchored Oligonucleotide.


General information
State: Published
Organisations: Department of Chemistry, Department of Micro- and Nanotechnology
Authors: Wackerbarth, H. (Intern), Grubb, M. (Intern), Marie, R. C. W. (Intern), Boisen, A. (Intern), Ulstrup, J. (Intern)
Publication date: 2004
SU-8 cantilever sensor with integrated read-out

General information
State: Published
Organisations: Department of Micro- and Nanotechnology
Authors: Johansson, A. (Intern), Gomez, M. (Intern), Rasmussen, P. (Intern), Marie, R. C. W. (Intern), Boisen, A. (Intern)
Pages: 488-490
Publication date: 2004

Host publication information
Title of host publication: Proceedings of MicroTAS 2004
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 61827
Publication: Research - peer-review › Article in proceedings – Annual report year: 2004

SU-8 cantilevers and one-step functionalization for DNA sensing

General information
State: Published
Organisations: Department of Micro- and Nanotechnology
Authors: Marie, R. C. W. (Intern), Schmid, S. (Ekstern)
Publication date: 2004

Host publication information
Title of host publication: Proceedings of Nanotech 2004. The 8th Annual European Conference On
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 61685
Publication: Research - peer-review › Article in proceedings – Annual report year: 2004

SU-8 cantilever sensor with integrated read-out

General information
State: Published
Organisations: Department of Micro- and Nanotechnology
Authors: Johansson, A. (Intern), Gomez, M. (Intern), Rasmussen, P. (Intern), Marie, R. C. W. (Intern), Boisen, A. (Intern)
Pages: 243-244
Publication date: 2004

Host publication information
Title of host publication: Proceedings of EuroSensors
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 61815
Publication: Research - peer-review › Article in proceedings – Annual report year: 2004

Thiol- and Disulfide-modified Oligonucleotide Monolayer Structures on Polycrystalline and Single-Crystal Au(111) Surfaces

General information
State: Published
Organisations: Department of Chemistry, Department of Micro- and Nanotechnology, Department of Physics
Pages: 474-481
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Solid State Electrochemistry
Volume: 8
ISSN (Print): 1432-8488
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.26 SJR 0.662 SNIP 0.721
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.652 SNIP 0.679 CiteScore 2.18
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.834 SNIP 1.009 CiteScore 2.59
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.735 SNIP 0.926 CiteScore 2.25
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.88 SNIP 1.009 CiteScore 2.23
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.871 SNIP 1.002 CiteScore 2.28
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.9 SNIP 0.974
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.851 SNIP 0.908
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.754 SNIP 0.738
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.78 SNIP 0.776
Scopus rating (2006): SJR 0.773 SNIP 0.961
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.63 SNIP 0.84
Scopus rating (2004): SJR 0.53 SNIP 0.766
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.537 SNIP 0.711
Scopus rating (2002): SJR 0.738 SNIP 0.81
Scopus rating (2001): SJR 0.763 SNIP 0.86
Scopus rating (2000): SJR 0.675 SNIP 0.617
Scopus rating (1999): SJR 0.664 SNIP 0.758
Original language: English
Source: orbit
Source-ID: 135933
Publication: Research - peer-review › Journal article – Annual report year: 2004
A cantilever-based sensor for thermal cycling in buffer solution

General information
State: Published
Organisations: Department of Micro- and Nanotechnology
Authors: Marie, R. C. W. (Intern), Thaysen, J. (Ekstern), Christensen, C. B. V. (Intern), Boisen, A. (Intern)
Pages: 893-898
Publication date: 2003
Main Research Area: Technical/natural sciences

Publication information
Journal: Microelectronic Engineering
Volume: 67
Issue number: 8
ISSN (Print): 0167-9317
Ratings:
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.69 SJR 0.606 SNIP 0.999
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.533 SNIP 0.856 CiteScore 1.35
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.592 SNIP 0.897 CiteScore 1.44
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.602 SNIP 1.001 CiteScore 1.45
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.745 SNIP 0.983 CiteScore 1.44
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.818 SNIP 1.169 CiteScore 1.8
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.946 SNIP 1.119
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.847 SNIP 1.127
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.05 SNIP 1.077
Adsorption kinetics and mechanical properties of thiol-modified DNA-oligos on gold investigated by microcantilever sensors

Immobilised DNA-oligo layers are scientifically and technologically appealing for a wide range of sensor applications such as DNA chips. Using microcantilever-based sensors with integrated readout, we demonstrate in situ quantitative studies of surface-stress formation during self-assembly of a 25-mer thiol-modified DNA-oligo layer. The self-assembly induces a surface-stress change, which closely follows Langmuir adsorption model. The adsorption results in compressive surface-stress formation, which might be due to intermolecular repulsive forces in the oligo layer. The rate constant of the adsorption depends on the concentration of the oligo solution. Based on the calculated rate constants a surface free energy of the thiol-modified DNA-oligo adsorption on gold is found to be -32.4 kJ mol\(^{-1}\). The adsorption experiments also indicate that first a single layer of DNA-oligos is assembled on the gold surface after which a significant unspecific adsorption takes place on top of the first DNA-oligo layer. The cantilever-based sensor principle has a wide range of applications in real-time local monitoring of chemical and biological interactions as well as in the detection of specific DNA sequences, proteins and particles. (C) 2002 Elsevier Science B.V. All rights reserved.

General information
State: Published
Organisations: Department of Micro- and Nanotechnology
Authors: Marie, R. C. W. (Intern), Jensenius, H. (Intern), Thaysen, J. (Intern), Christensen, C. B. V. (Intern), Boisen, A. (Intern)
Pages: 29-36
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: Ultramicroscopy
Volume: 91
Issue number: 1-4
ISSN (Print): 0304-3991
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.82 SJR 1.915 SNIP 1.233
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.121 SNIP 1.428 CiteScore 2.78
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
DNA immobilisator on gold surface for biosensors and microsystems; a fluorescence scanning study

General information
State: Published
Organisations: Department of Micro- and Nanotechnology
Authors: Marie, R. C. W. (Intern), Christensen, C. B. V. (Intern), Boisen, A. (Intern)
Publication date: 2002

Host publication information
Title of host publication: Proceedings of the Micro- and nanoengineering (MNE)
Main Research Area: Technical/natural sciences
Source: orbit
DNA Immobilisator on gold surface for biosensors and microsystems; a fluorescent scanning study

General information
State: Published
Organisations: Department of Micro- and Nanotechnology
Authors: Marie, R. C. W. (Intern), Christensen, C. B. V. (Intern), Boisen, A. (Intern)
Publication date: 2002

Host publication information
Title of host publication: Proceedings of the Medicon Vally Academy
Main Research Area: Technical/natural sciences
Source: orbit

Cantilever-based bio-chemical sensor integrated in a micro-liquid handling system
The cantilevers have integrated piezoresistive readout which, compared to optical readout, enables simple measurements on even non-transparent liquids, such as blood. First, we introduce a simple theory for using piezoresistive cantilevers as surface stress sensors. Then, the sensor fabrication based on conventional microfabrication is described and the sensor characterization is discussed. During the characterization we found a stress sensitivity of (ΔR/R)=4.6·10^-4 (N/m)-1 and a minimum detectable surface stress change of 2.6 mN/m. Aqua regia etch of gold on top of the cantilevers has been monitored, and immobilization of single-stranded thiol modified DNA-oligos has been detected by the sensor. Finally, it is demonstrated that it is possible to analyze two samples simultaneously by utilizing the laminar flow in the micro-liquid handling system.

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, NSE-Optofluidics Group, NanoSystemsEngineering Section, Nanoprobes Group
Authors: Thaysen, J. (Intern), Marie, R. (Intern), Boisen, A. (Intern)
Pages: 401-404
Publication date: 2001

Host publication information
Title of host publication: Proceedings of The 14th IEEE International Conference on Micro Electro Mechanical Systems
Publisher: IEEE
ISBN (Print): 0-7803-5998-4
Main Research Area: Technical/natural sciences
Conference: 14th IEEE International Conference on Micro Electro Mechanical Systems, Interlaken, Switzerland, 21/01/2001 - 21/01/2001
Electronic versions:
boisen.pdf
DOIs:
10.1109/MEMSYS.2001.906561

Bibliographical note
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Source: orbit
Source-ID: 61291
Publication: Research - peer-review › Article in proceedings – Annual report year: 2001

Projects:

Nanofluidics devices for bioimaging
Department of Micro- and Nanotechnology
Period: 01/11/2017 → 31/10/2020
Number of participants: 3
Phd Student:
Rasmussen, Martin Kjærulf (Intern)
Supervisor:
Pedersen, Jonas Nyvold (Intern)
Main Supervisor:
Marie, Rodolphe (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Micro and nanofluidics for genomic DNA Sequencing
Department of Micro- and Nanotechnology
Period: 01/02/2013 → 31/01/2016
Number of participants: 3
Phd Student:
Eriksen, Johan (Intern)
Supervisor:
Kristensen, Anders (Intern)
Main Supervisor:
Marie, Rodolphe (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden EU-finansiering
Project: PhD

Microfluidics for single cell analysis
Department of Micro- and Nanotechnology
Period: 15/09/2012 → 09/12/2015
Number of participants: 6
Phd Student:
Jensen, Marie Pødenphant (Intern)
Supervisor:
Kristensen, Anders (Intern)
Main Supervisor:
Marie, Rodolphe (Intern)
Examiner:
Bruus, Henrik (Intern)
Kutter, Jörg Peter (Intern)
Laurell, Thomas (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Grundforskningsfonden
Project: PhD

Opto-Thermal actuation in micro and fluidics
Department of Micro- and Nanotechnology
Period: 01/10/2010 → 15/01/2014
Number of participants: 6
Phd Student:
Lüscher, Christopher James (Intern)
Supervisor:
Marie, Rodolphe (Intern)
Main Supervisor:
Kristensen, Anders (Intern)
Examiner:
Mortensen, N. Asger (Intern)
Levy, Uriel (Ekstern)
Montelius, Lars (Ekstern)

Financial sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Quantification of biomolecular interactions with soft material
Department of Micro- and Nanotechnology
Period: 01/09/2010 → 19/02/2014
Number of participants: 5
Phd Student:
Kristensen, Kasper (Intern)
Main Supervisor:
Andresen, Thomas Lars (Intern)
Examiner:
Marie, Rodolphe (Intern)
Ipsen, John Hjorth (Intern)
Wimley, William C. (Ekstern)

Financial sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Nucleic acid Reactions Investigated by Cantilever Based Sensors
Department of Micro- and Nanotechnology
Period: 01/01/2001 → 12/05/2004
Number of participants: 5
Phd Student:
Marie, Rodolphe (Intern)
Supervisor:
Christensen, Claus Bo Vøge (Intern)
Main Supervisor:
Boisen, Anja (Intern)
Examiner:
Pedersen, Lars Hag (Intern)
Gómez, Laura M. Lechuga (Ekstern)

Financial sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Activities:

Mapping Single DNA Molecules to the Human Genome in a Nanofluidic Device
Period: 4 Nov 2014
Rodolphe Marie (Lecturer)
Department of Micro- and Nanotechnology
Optofluidics

Description
Invited talk at Single Molecule Biology and Genome Editing Europe, November 4 2014, Cambridge, UK
Related event

**Single Molecule & Genome Engineering/Editing Europe 2014 Meeting**

03/11/2014 → 04/11/2014
Cambridge, United Kingdom
Activity: Talks and presentations › Conference presentations

**Mapping Single DNA Molecules to the Human Genome in a Nanofluidic Device**
Period: 4 Nov 2014
Rodolphe Marie (Lecturer)
Department of Micro- and Nanotechnology
Optofluidics

**Description**
Marie, R., Pedersen, J. N., L. Bauer, D., Rasmussen, K. H., Yusuf, M., Volpi, E., U Mir, K., Flyvbjerg, H. and Kristensen, A

Invited talk.

Related event

**Single Molecule & Genome Engineering/Editing Europe 2014 Meeting**
03/11/2014 → 04/11/2014
Cambridge, United Kingdom
Activity: Talks and presentations › Conference presentations

**Visualizing Structural Variations Of Single DNA Molecules In A Nanofluidic Device**
Period: 24 Jun 2014
Rodolphe Marie (Lecturer)
Department of Micro- and Nanotechnology
Optofluidics

**Description**
Marie, R., Pedersen, J. N., L. Bauer, D., Rasmussen, K. H., Yusuf, M., Volpi, E., U Mir, K., Flyvbjerg, H. and Kristensen, A

Related event

**4th International Workshop on Analytical Miniaturization and NANOtechnologies**
23/06/2014 → 24/06/2014
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

**Visualizing Structural Variations Of Single DNA Molecules In A Nanofluidic Device**
Period: 10 Mar 2014 → 11 Mar 2014
Rodolphe Marie (Lecturer)
Department of Micro- and Nanotechnology
Optofluidics

**Description**
Marie, R., Pedersen, J. N., L. Bauer, D., Rasmussen, K. H., Yusuf, M., Volpi, E., U Mir, K., Flyvbjerg, H. and Kristensen, A

Invited talk at the Single Cell Analysis Europe on March 10-11 2014 in Berlin, Germany.

Related external organisation

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations