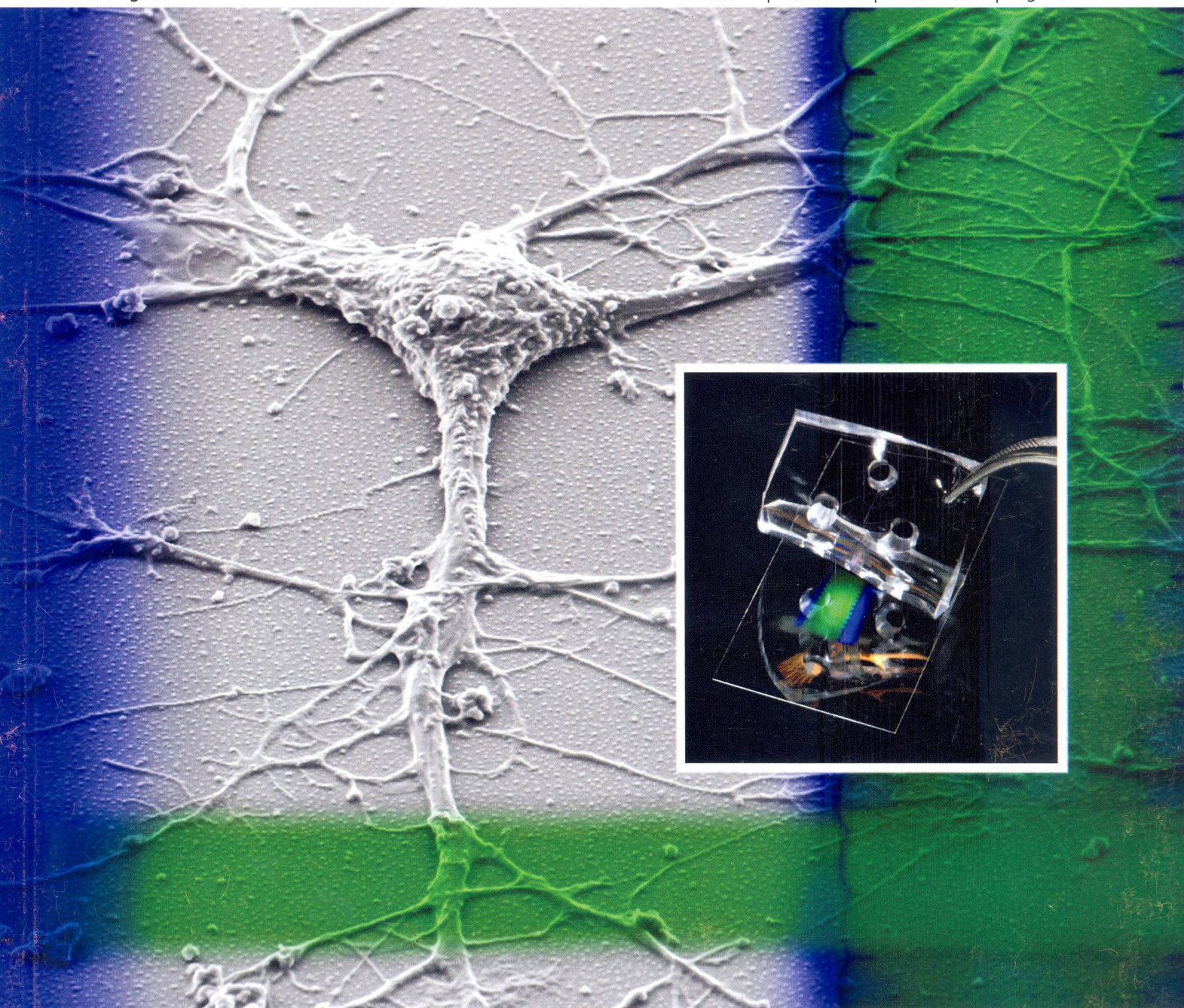


Lab on a Chip

Micro- & nano- fluidic research for chemistry, physics, biology, & bioengineering

www.rsc.org/loc

Volume 10 | Number 12 | 21 June 2010 | Pages 1493–1632



ISSN 1473-0197

RSC Publishing

Gillette
Guiding neuron development

Muller and Sohn
Single-molecule sequencing



1473-0197(2010)10:12;1-8

Lab on a Chip

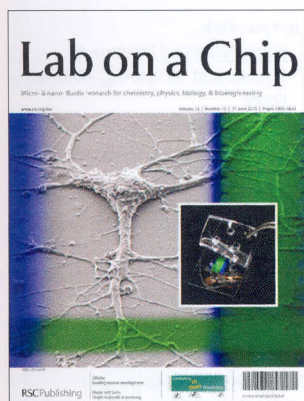
Micro- & nano- fluidic research for chemistry, physics, biology, & bioengineering

www.rsc.org/loc

RSC Publishing is a not-for-profit publisher and a division of the Royal Society of Chemistry. Any surplus made is used to support charitable activities aimed at advancing the chemical sciences. Full details are available from www.rsc.org

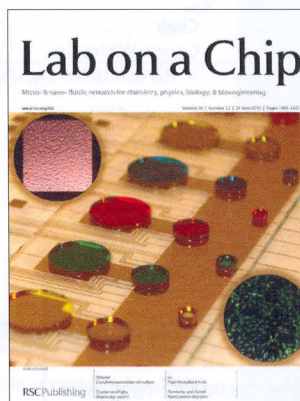
IN THIS ISSUE

ISSN 1473-0197 CODEN LCAHAM 10(12) 1493–1632 (2010)



Cover

Neuronal development can be engineered by surface-bound gradients of biochemical cues, signals that can be deposited with the use of microfluidic devices. Image created by Larry Millet, Janet Sinn-Hanlon and Darren Stevenson. Image reproduced by permission of Larry J. Millet, Matthew E. Stewart, Ralph G. Nuzzo and Martha U. Gillette from *Lab Chip*, 2010, **10**, 1525.



Inside cover

See Wheeler *et al.*, pp. 1536–1542. A digital microfluidic platform for complete mammalian cell culture in 150-nL droplets. Image reproduced by permission of Irena Barbulovic-Nad, Sam H. Au and Aaron R. Wheeler from *Lab Chip*, 2010, **10**, 1536.

HIGHLIGHT

1507

Research Highlights

Petra S. Dittrich*

Petra Dittrich reviews the current literature in miniaturisation and related technologies.



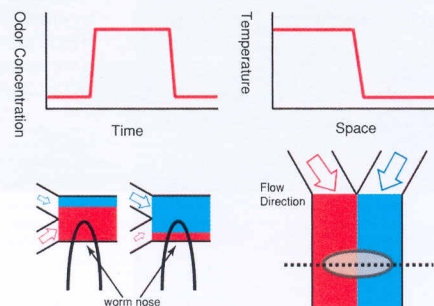
CRITICAL REVIEW

1509

Microfluidics-enabled phenotyping, imaging, and screening of multicellular organisms

Matthew M. Crane, Kwanghun Chung, Jeffrey Stirman and Hang Lu*

This paper will review the technologies that have been invented in the last few years on high-throughput phenotyping, imaging, screens, and related techniques using microfluidics.

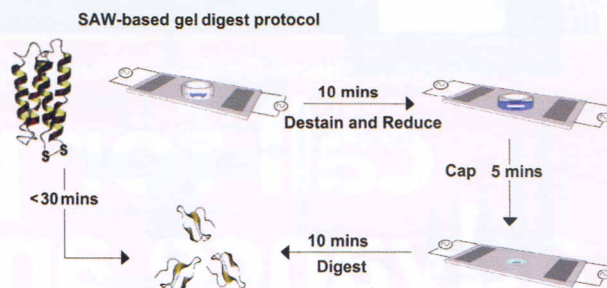


1518

Rapid microscale in-gel processing and digestion of proteins using surface acoustic waves

Ketav P. Kulkarni, Sri H. Ramarathinam, James Friend, Leslie Yeo, Anthony W. Purcell* and Patrick Perlmutter*

A new method, employing surface acoustic waves (SAWs) as the source of energy for in-gel sample processing and tryptic digestion of proteins is described.

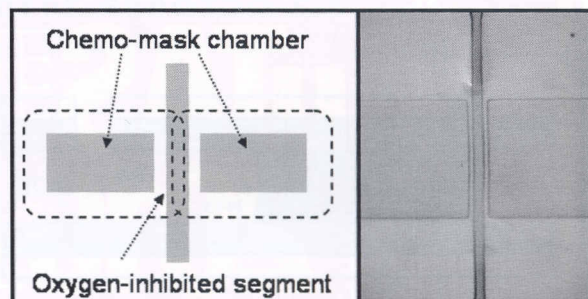


1521

Functional patterning of PDMS microfluidic devices using integrated chemo-masks

Mark B. Romanowsky, Michael Heymann, Adam R. Abate, Amber T. Krummel, Seth Fraden and David A. Weitz*

We introduce a new functional patterning method for PDMS microfluidic devices, using integrated oxygen reservoirs, which serve as “chemo-masks”. Oxygen diffuses through the PDMS to the nearby channel segments and there inhibits functional polymer growth; by placement of the chemo-masks, we thus control the polymerization pattern.



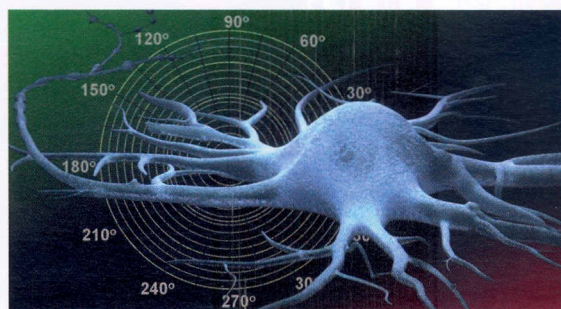
PAPERS

1525

Guiding neuron development with planar surface gradients of substrate cues deposited using microfluidic devices

Larry J. Millet, Matthew E. Stewart, Ralph G. Nuzzo and Martha U. Gillette*

Microfluidic devices can be used as a transient template to pattern stable, instructive surface-bound gradients for biology. Primary neurons orient to variations of gradients that produce distinct growth regimens.

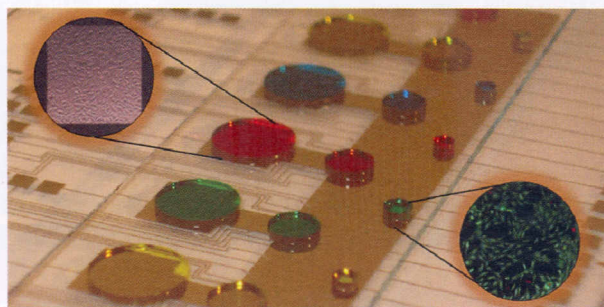


1536

A microfluidic platform for complete mammalian cell culture

Irena Barbulovic-Nad, Sam H. Au and Aaron R. Wheeler*

A miniaturized platform for complete mammalian cell culture has been implemented *via* digital microfluidics. In 150 nL droplets, cells are passaged and subcultured for weeks and then transiently transfected on the same platform.

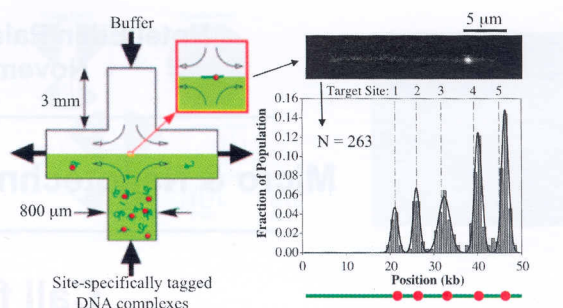


1543

Single-molecule sequence detection *via* microfluidic planar extensional flow at a stagnation point

Rebecca Dylla-Spears, Jacqueline E. Townsend,
Linda Jen-Jacobson, Lydia L. Sohn and Susan J. Muller*

Single DNA molecules are trapped and extended at the stagnation point of a planar extensional flow, where target site positions, indicated by fluorescent markers, are determined by fluorescence microscopy.

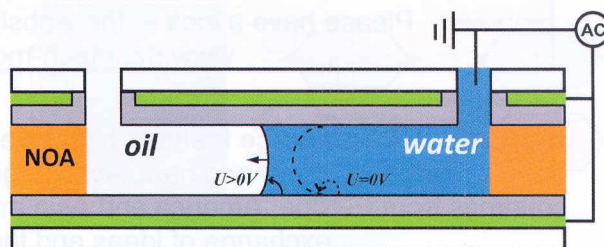


1550

A hybrid microfluidic chip with electrowetting functionality using ultraviolet (UV)-curable polymer

Hao Gu,* Michel H. G. Duits and Frieder Mugele

We present a novel method to fabricate microchannels with integrated electrowetting (EW) functionality based on the “microfluidic stickers” technology in combination with robust insulating layers made of Teflon AF. Using these devices we demonstrate EW-controlled filling of microfluidic channels as well as the generation of microdrops.

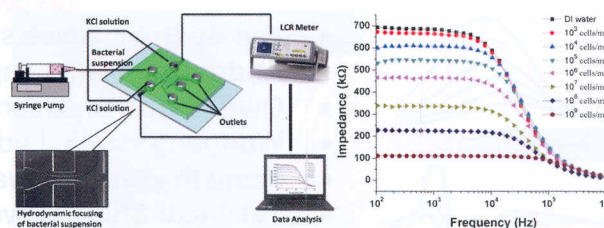


1557

Detection of bacterial cells by impedance spectra *via* fluidic electrodes in a microfluidic device

Tao Zhu, Zhenhua Pei, Jianyong Huang, Chunyang Xiong,*
Shenggen Shi and Jing Fang

We present a novel method for detecting bacterial cells in deionized (DI) water suspension by using fluidic electrodes with a hydrodynamic focusing technique.

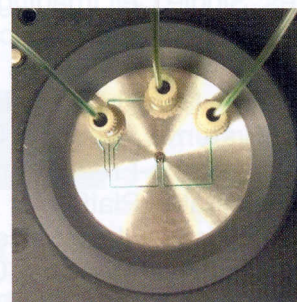


1561

Attenuated total reflection Fourier transform infrared spectroscopy for on-chip monitoring of solute concentrations

Jesse Greener, Bardia Abbasi and Eugenia Kumacheva*

A robust and cost-efficient *in situ* ATR-FTIR method is proposed for rapid acquisition of high-resolution spectra of solutes flowing through microfluidic channels.

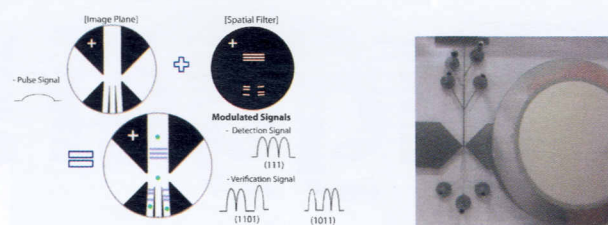


1567

Human mammalian cell sorting using a highly integrated micro-fabricated fluorescence-activated cell sorter (μ FACS)

Sung Hwan Cho,* Chun H. Chen, Frank S. Tsai, Jessica M. Godin and Yu-Hwa Lo

The novel high fluorescence detection strategy called “space-time coding” technique and the on chip PZT actuator realized a lab-on-a-chip sorter with high purity and high throughput.

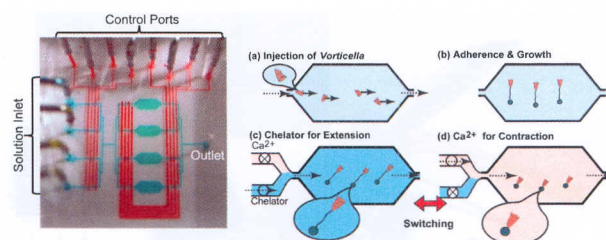


1574

Chemical control of *Vorticella* bioactuator using microfluidics

Moeto Nagai,* Sangjin Ryu, Todd Thorsen, Paul Matsudaira and Hiroyuki Fujita

We demonstrate a microfluidic platform to control the stalk contraction and extension of *Vorticella convallaria* by changing concentration of Ca^{2+} with pneumatically-actuated elastomeric microvalves.

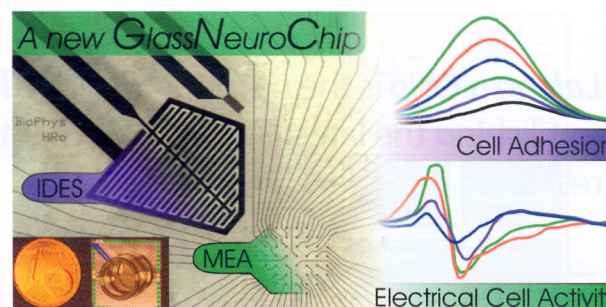


1579

Modular glass chip system measuring the electric activity and adhesion of neuronal cells—application and drug testing with sodium valproic acid

Philipp Julian Koester, Sebastian Moritz Buehler, Marco Stubbe, Carsten Tautorat, Mathias Niendorf, Werner Baumann and Jan Gimsa*

Koester *et al.* present a glass-chip system combining a microelectrode array (MEA) for detecting the electrical activity of neurons or cardiomyocytes with a sensor (IDES) for cell number and adhesion.

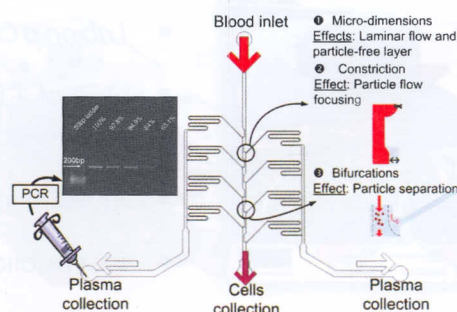


1587

Validation of a blood plasma separation system by biomarker detection

Maiwenn Kersaudy-Kerhoas,* Deirdre M. Kavanagh, Resham S. Dhariwal, Colin J. Campbell and Marc P. Y. Desmulliez

The blood plasma separation system features constrictions and bifurcations in series and relies solely on hydrodynamic forces. This device has been validated by the detection of a house-keeping gene sequence in the extracted plasma.

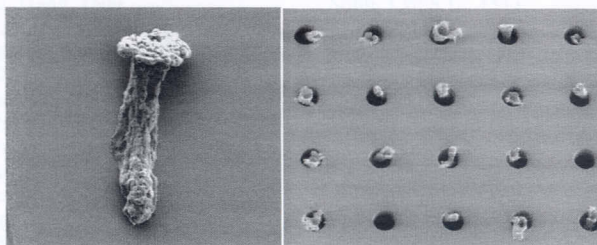


1596

Microdevice to capture colon crypts for *in vitro* studies

Yuli Wang, Rahul Dhopeswarkar, Rani Najdi,
Marian L. Waterman, Christopher E. Sims
and Nancy Allbritton*

Colon crypts were arrayed on a simple microfabricated device for differential access to the luminal and basal sides.

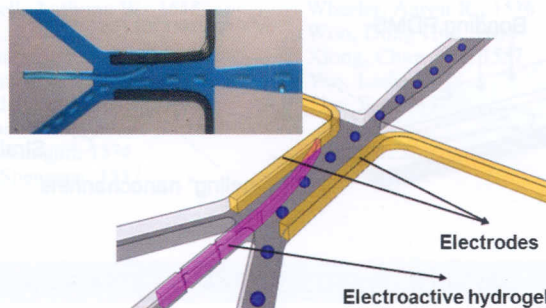


1604

Electrically-driven hydrogel actuators in microfluidic channels: fabrication, characterization, and biological application

Gu Han Kwon, Yoon Young Choi, Joong Yull Park,
Dong Hun Woo, Kyu Back Lee, Jong Hoon Kim
and Sang-Hoon Lee*

We have demonstrated that electroactive hydrogels can be successfully integrated into a microfluidic system and can operate rapidly without generating bubbles.

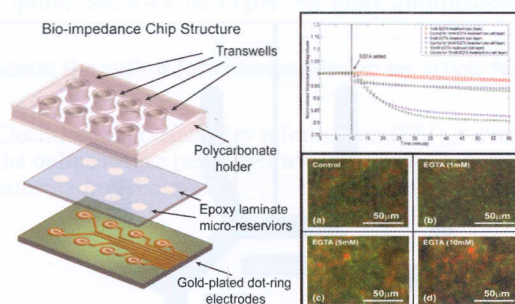


1611

On-chip epithelial barrier function assays using electrical impedance spectroscopy

Tao Sun,* Emily J. Swindle, Jane E. Collins,
Judith A. Holloway, Donna E. Davies and Hywel Morgan*

In this paper, a bio-impedance chip has been developed for real-time monitoring of the kinetics of epithelial cell monolayers *in vitro*.

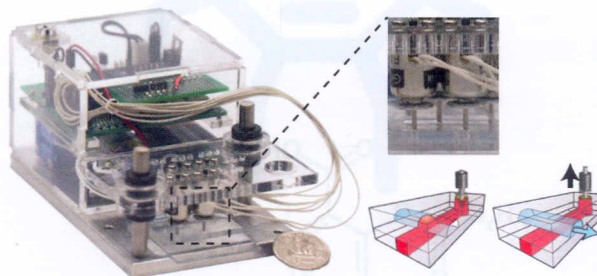


1618

Actuation of elastomeric microvalves in point-of-care settings using handheld, battery-powered instrumentation

Kweku A. Addae-Mensah, Yuk Kee Cheung,
Veronika Fekete, Matthew S. Rendely and Samuel K. Sia*

We demonstrate that elastomeric microvalves, via liquid-filled control channels, can be actuated using only a compact and battery-powered instrument. This technique may enable the widely used elastomeric valves (made by multilayer soft lithography) to be increasingly adopted for portable sensors and lab-on-a-chip systems.



1623

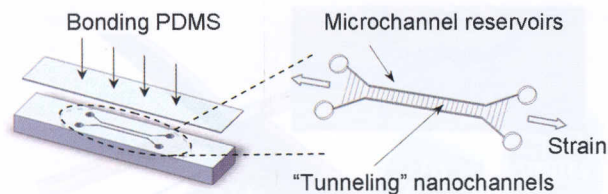


Better shrinkage than Shrinky-Dinks

Diep Nguyen, Douglas Taylor, Kun Qian, Nizilla Norouzi, Jerald Rasmussen, Steve Botzet, Matt Lehmann, Kurt Halverson and Michelle Khine*

We demonstrate the ability to rapidly and easily create unique microstructures, increase microarray feature density, and induce self-assembled integrated metallic nanostructures with polyolefin shrink wrap films that shrink by 95%.

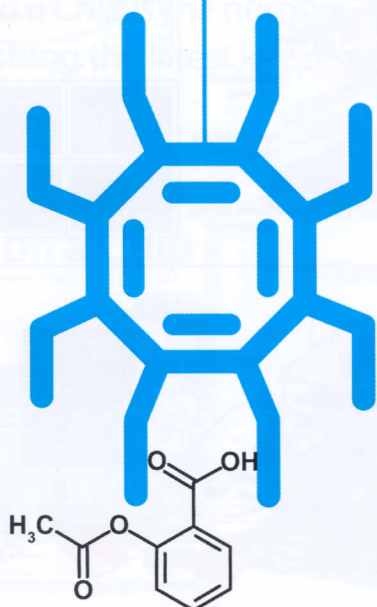
1627



Instantaneous fabrication of arrays of normally closed, adjustable, and reversible nanochannels by tunnel cracking

K. L. Mills, Dongeun Huh, Shuichi Takayama* and M. D. Thouless*

Tunnel cracking of oxidized, bonded PDMS to produce size-adjustable nanochannels in a direct and simple fashion.



New adventures on the web

ChemSpider is a free online, structure centric community for chemists, providing fast access to millions of unique chemical entities, resources and information and the opportunity to collaborate with a world wide community of scientists. Rapidly becoming the richest single source of structure based chemistry information online, ChemSpider is a ground breaking initiative now supported by the RSC, the most innovative of chemical societies.

www.chemspider.com

RSC | Advancing the
Chemical Sciences
Registered Charity No. 207890

ChemSpider
Building community for chemists