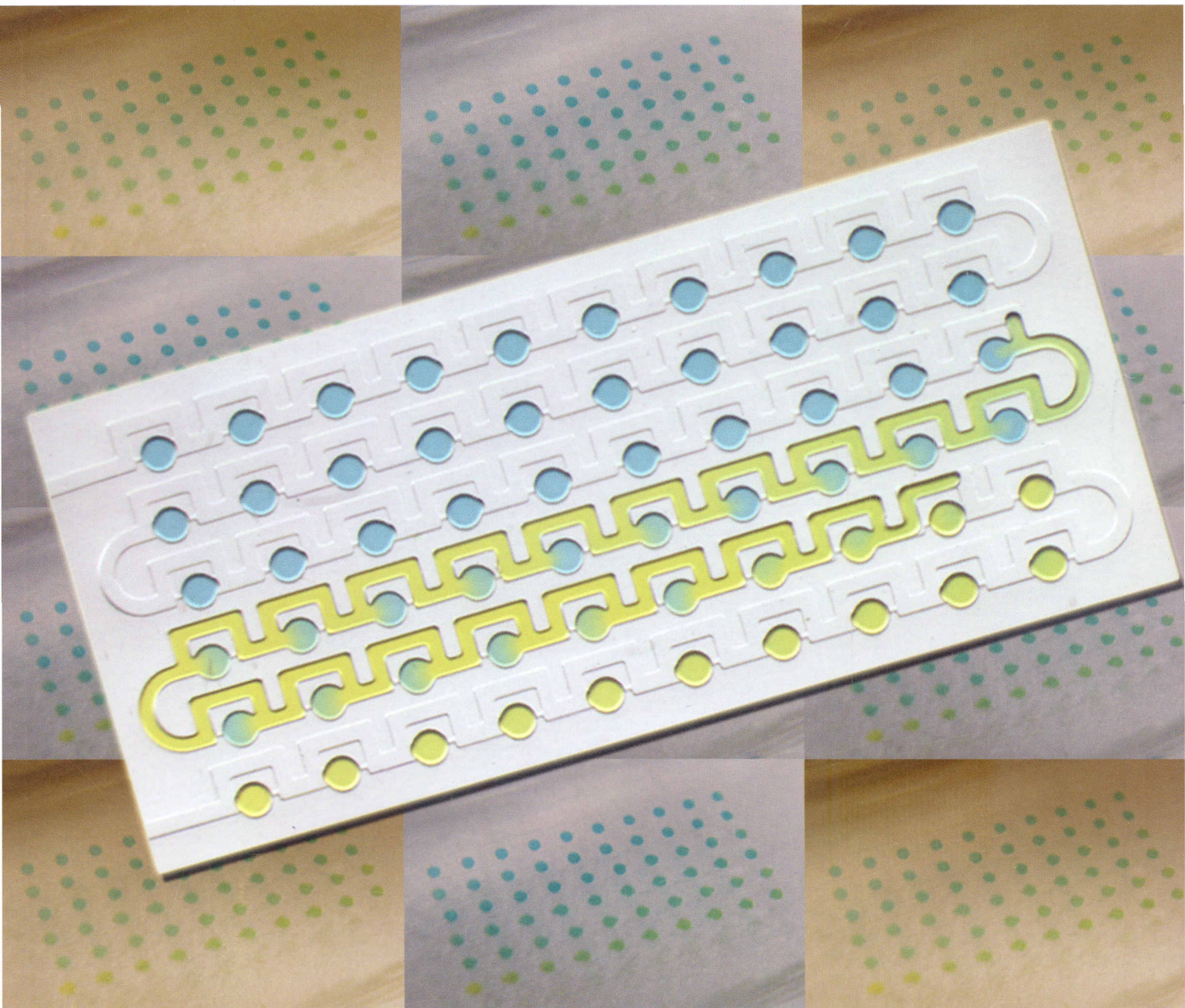


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COMMUNICATION

Vanapalli *et al.*

Microfluidic static droplet arrays with tuneable gradients in material composition



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Cover

See Vanapalli *et al.*, pp. 3949–3952. Image reproduced by permission of Siva A. Vanapalli from *Lab Chip*, 2011, **11**, 3949.



Inside cover

See Oh *et al.*, pp. 3956–3962. Image reproduced by permission of Kwang W. Oh from *Lab Chip*, 2011, **11**, 3956.

HIGHLIGHT

3937

Research highlights

Šeila Selimović, Omar Z. Fisher and Ali Khademhosseini*

Fabrication across length scales - Microfiber coding - Polymers with face memory - Dry blood microdiagnostics.



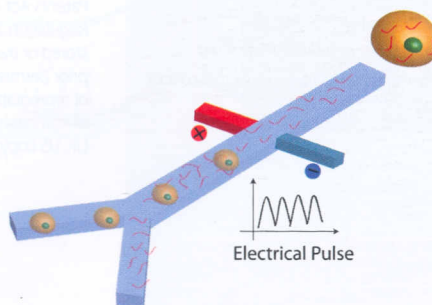
CRITICAL REVIEW

3941

Microfluidic approaches for gene delivery and gene therapy

Jungkyu Kim, Inseong Hwang, Derek Britain, Taek Dong Chung, Yu Sun* and Deok-Ho Kim*

This article reviews the state-of-the-art microfluidics-mediated gene transfection techniques and microfluidic approaches for the fabrication of gene carriers.

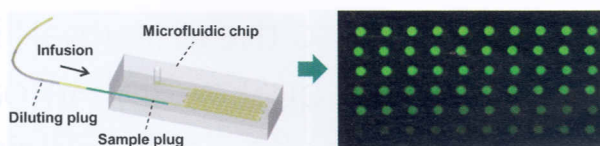


3949

Microfluidic static droplet arrays with tuneable gradients in material composition

Meng Sun, Swastika S. Bithi and Siva A. Vanapalli*

A simple technique to generate static arrays of microfluidic drops with variation in reagent concentration.

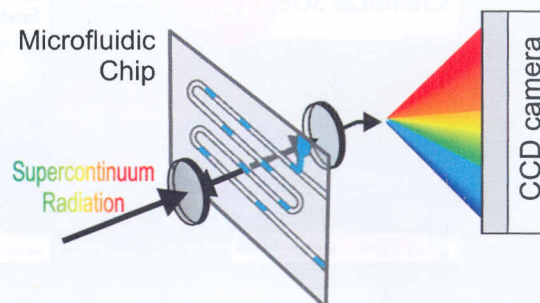


3953

Broadband cavity-enhanced absorption spectroscopy for real time, *in situ* spectral analysis of microfluidic droplets

Simon R. T. Neil, Cathy M. Rushworth, Claire Vallance* and Stuart R. Mackenzie*

Broadband cavity-enhanced absorption spectroscopy yields the full visible absorption spectra of microfluidic droplets *in situ* in < 4 ms.



PAPERS

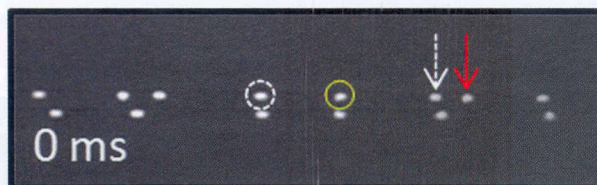
3956

Parallel synchronization of two trains of droplets using a railroad-like channel network

Byungwook Ahn, Kangsun Lee, Hun Lee, Rajagopal Panchapakesan and Kwang W. Oh*

We investigated a droplet synchronization method using a railroad-like channel network, in which a top and a bottom channel are connected with a ladder network.

Parallel synchronization of two trains of droplets using a railroad-like channel network

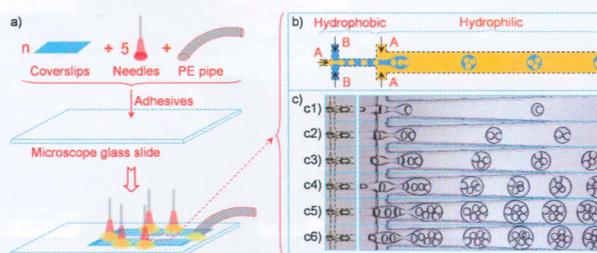


3963

Simple and cheap microfluidic devices for the preparation of monodisperse emulsions

Nan-Nan Deng, Zhi-Jun Meng, Rui Xie,* Xiao-Jie Ju, Chuan-Lin Mou, Wei Wang and Liang-Ying Chu*

Simple and cheap microfluidic devices based on patterned coverslips and glass slides, have been developed to generate monodisperse emulsions with highly controllable flexibility.

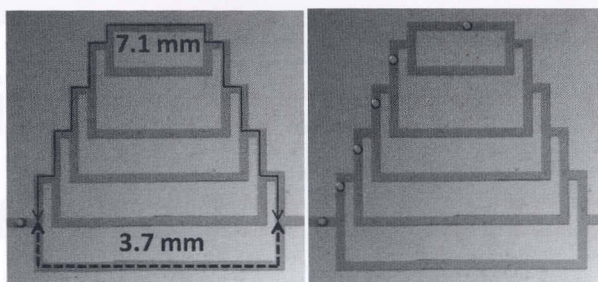


3970

Bubbles navigating through networks of microchannels

Wonjae Choi, Michinao Hashimoto, Audrey K. Ellerbee, Xin Chen, Kyle J. M. Bishop, Piotr Garstecki, Howard A. Stone and George M. Whitesides*

Bubbles traveling in complex microfluidic networks can display counter-intuitive behavior. A preference for a longer path, when shorter ones are available, is an example.

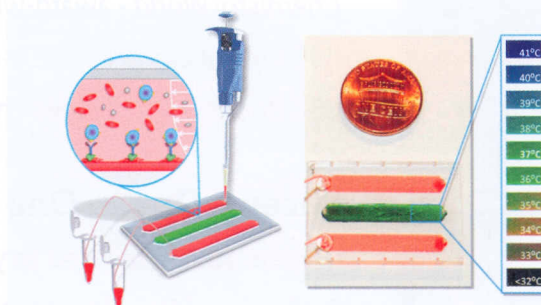


3979

Controlled viable release of selectively captured label-free cells in microchannels

Umüt Atakan Gurkan, Tarini Anand, Huseyin Tas, David Elkan, Altug Akay, Hasan Onur Keles and Utkan Demirci*

We present a new approach to rapidly release the selectively captured cells in thermoresponsive microchannels with high specificity and post-release viability by using simple manual pipettors and short processing times.

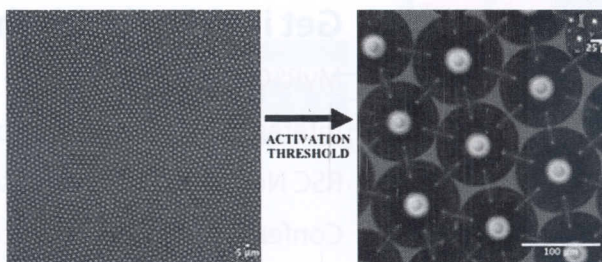


3990

High-speed, clinical-scale microfluidic generation of stable phase-change droplets for gas embolotherapy

David Bardin, Thomas D. Martz, Paul S. Sheeran, Roger Shih, Paul A. Dayton and Abraham P. Lee*

We report on a microfluidic device and droplet formation regime capable of generating clinical-scale quantities of liquid perfluorocarbon phase-change droplets suitable in size and functionality for *in vivo* gas embolotherapy.

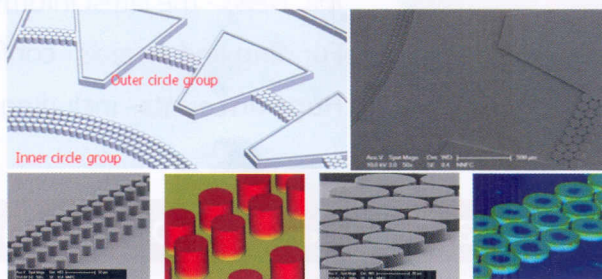


3999

Sustainable fabrication of micro-structured lab-on-a-chip

Hwa Jin Oh, Jae Hong Park, Seok Jae Lee, Byeong Il Kim, Young Seok Song* and Jae Ryoung Youn*

A sustainable platform to fabricate micro-structured lab-on-a-chip was introduced. The mold filling process of microinjection molding was investigated experimentally and the underlying filling mechanism for microstructures was elucidated numerically based on multiscale modeling.

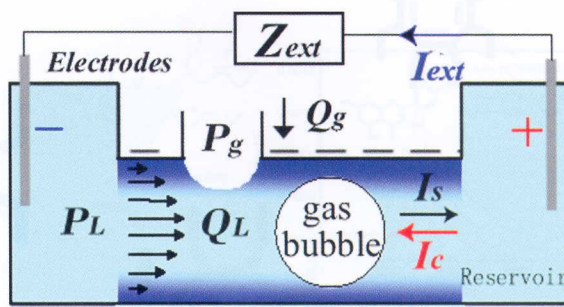


4006

Strong enhancement of streaming current power by application of two phase flow

Yanbo Xie, John D. Sherwood, Lingling Shui,
Albert van den Berg and Jan C. T. Eijkel

In single-phase systems the internal conduction current (I_C) induced by the streaming potential decreases the current in the external circuit ($I_{\text{ext}} = I_S - I_C$), which will limit the output power.

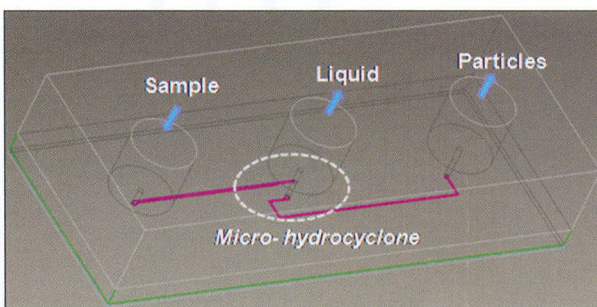


4012

Microfluidic device based on a micro-hydrocyclone for particle-liquid separation

P. Bhardwaj, P. Bagdi and A. K. Sen*

A 'micro-hydrocyclone' device that includes a cylindrical flow-chamber with a frustoconical bottom, an inlet channel that is tangential to the chamber and a 'vortex finder', is used for particle-liquid separation.

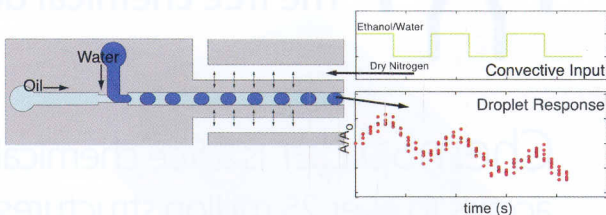


4022

Active control of nanolitre droplet contents with convective concentration gradients across permeable walls

Ramsey I. Zeitoun, Marcus J. Goudie, Jacob Zwier,
David Mahawilli and Mark A. Burns*

Droplet sizes and contents are actively controlled using a dynamic convective signal.

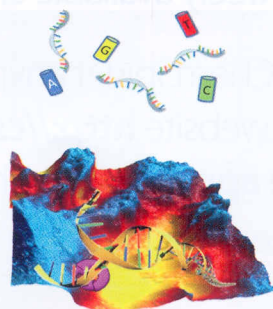


4029

Solid phase DNA extraction on PDMS and direct amplification

Laura Pasquardini,* Cristina Potrich, Marzia Quaglio,
Andrea Lamberti, Salvatore Guastella, Lorenzo Lunelli,
Matteo Cocuzza, Lia Vanzetti, Candido Fabrizio Pirri
and Cecilia Pederzoli

DNA is purified from blood taking advantage of its natural propensity to adsorb on PDMS and the amplification reaction is performed directly on adsorbed DNA without elution being necessary.

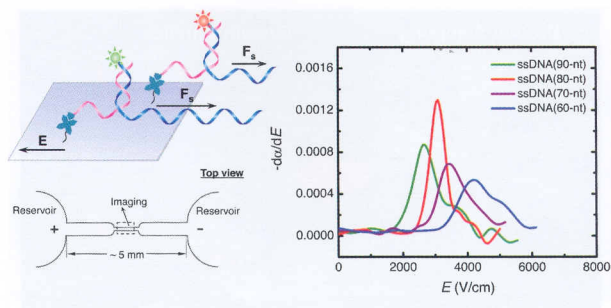


4036

Separation of single-stranded DNA fragments at a 10-nucleotide resolution by stretching in microfluidic channels

Jiamin Wu, Shuang-Liang Zhao, Lizeng Gao, Jianzhong Wu and Di Gao*

Efficient separation of ssDNA at a 10-nt resolution is demonstrated by first tethering the DNA fragments to a solid surface and then sequentially pulling the DNA off the surface using an electric field applied along a microfluidic channel.

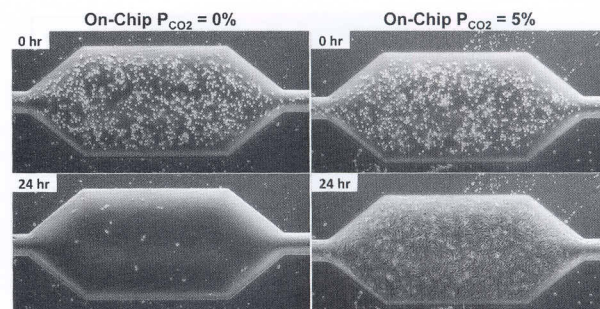


4041

On-chip CO₂ control for microfluidic cell culture

Samuel P. Forry* and Laurie E. Locascio

A system that allows on-chip control of the carbon dioxide partial pressure (P_{CO_2}) in stagnant culture chambers while mitigating pervaporation.

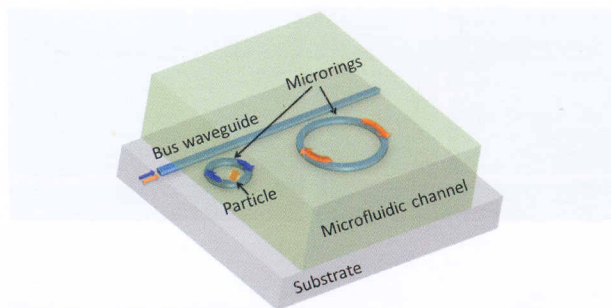


4047

Planar silicon microrings as wavelength-multiplexed optical traps for storing and sensing particles

Shiyun Lin and Kenneth B. Crozier*

We integrate micro-ring resonators and waveguides with microfluidics. Particles can be moved between the micro-rings by tuning the laser wavelength.

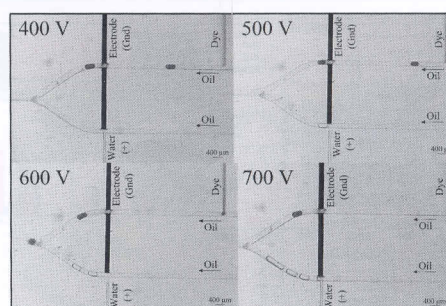


4052

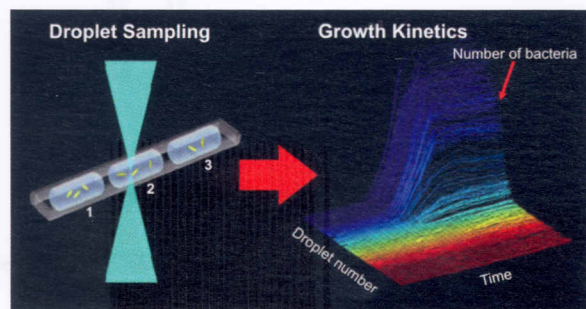
A microfluidic device for self-synchronised production of droplets

Ruchi Gupta,* Sara J. Baldock, Pilar Carreras, Peter R. Fielden, Nick J. Goddard, Stephan Mohr, Behnam S. Razavi and Bernard J. Treves Brown

A novel device for self-synchronous production of droplets has been demonstrated. The device uses a change in impedance across a pair of electrodes introduced due to the passage of a pre-formed droplet to generate a second droplet at a second pair of electrodes.



4057

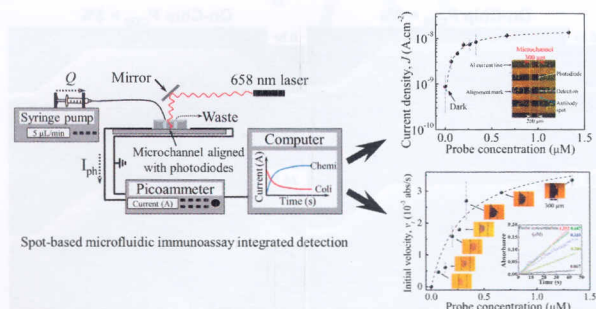


Millifluidic droplet analyser for microbiology

Larysa Baraban,* Fabien Bertholle, Merijn L. M. Salverda, Nicolas Bremond,* Pascal Panizza, Jean Baudry, J. Arjan G. M. de Visser and Jérôme Bibette

A new fluidic machine to study the growth kinetics and antibiotic resistance of microbial cultures encapsulated in water-in-oil emulsion droplets is proposed.

4063



Microspot-based ELISA in microfluidics: chemiluminescence and colorimetry detection using integrated thin-film hydrogenated amorphous silicon photodiodes

Pedro Novo, Duarte Miguel França Prazeres, Virginia Chu and João Pedro Conde*

We demonstrate a microfluidic system, with on channel multiplexed microspotted probes, integrated with optical detection using amorphous silicon photodiodes.

4072

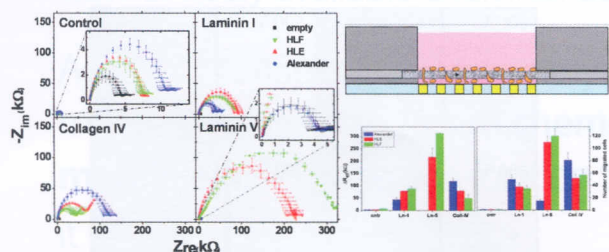


On-chip measurements of cell compressibility *via* acoustic radiation

Deny Hartono, Yang Liu, Pei Lin Tan, Xin Yi Sherlene Then, Lin-Yue Lanry Yung and Kian-Meng Lim*

We report a new method for fast and direct measurement of the compressibility or bulk modulus of various cell lines on a microchip.

4081



Automatic transwell assay by an EIS cell chip to monitor cell migration

Elisabetta Primiceri,* Maria Serena Chiriaco, Francesca Dioguardi, Anna Grazia Monteduro, Eliana D'Amone, Ross Rinaldi, Gianluigi Giannelli and Giuseppe Maruccio*

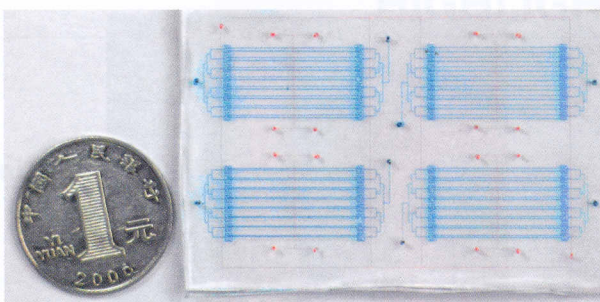
EIS cell chips for automatic transwell assays to monitor cell migration are demonstrated outperforming traditional assays with application in drug discovery.

4087

A scalable microfluidic chip for bacterial suspension culture

Mingzhe Gan, Jing Su, Jing Wang, Hongkai Wu and Liwei Chen*

A multi-layered chip design allows for scalable microbial suspension culture chips with parallel culture channel loops.

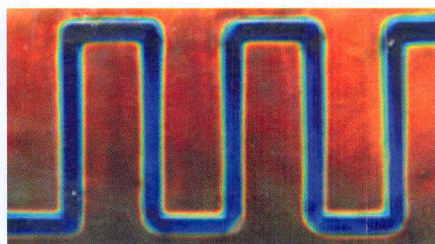


4093

Monitoring spatial distribution of ethanol in microfluidic channels by using a thin layer of cholesteric liquid crystal

Laura Sutarlie and Kun-Lin Yang*

We report the utility of a cholesteric liquid crystal (CLC) which gives colorimetric response to ethanol inside microfluidic channels.



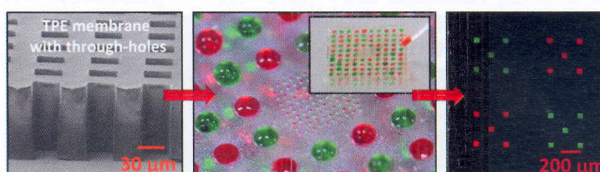
5 mm

4099

3D thermoplastic elastomer microfluidic devices for biological probe immobilization

Daniel Brassard,* Liviu Clime, Kebin Li, Matthias Geissler, Caroline Miville-Godin, Emmanuel Roy and Teodor Veres

We report on 3D microfluidic devices based on thermoplastic elastomer membranes with microscopic through-holes for the immobilization of biological probes.



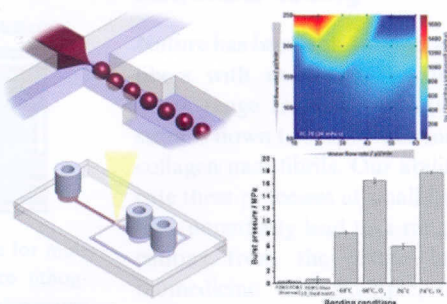
TECHNICAL NOTES

4108

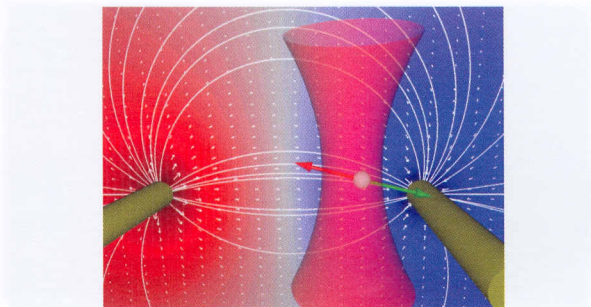
Thermoset polyester droplet-based microfluidic devices for high frequency generation

Jin-young Kim, Andrew J. deMello, Soo-Ik Chang, Jongin Hong* and Danny O'Hare*

Droplet-based microfluidic devices to withstand high pressure have been successfully fabricated using thermoset polyester (TPE) materials for high frequency generation of droplets.



4113

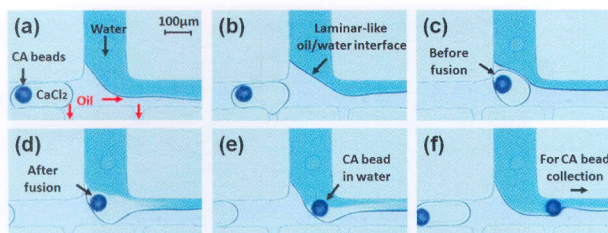


Mapping electric fields generated by microelectrodes using optically trapped charged microspheres

Giuseppe Pesce,* Biagio Mandracchia, Emanuele Orabona, Giulia Rusciano, Luca De Stefano and Antonio Sasso

A charged microscopic particle held in optical tweezers is able to measure the electric field generated by microelectrodes.

4117

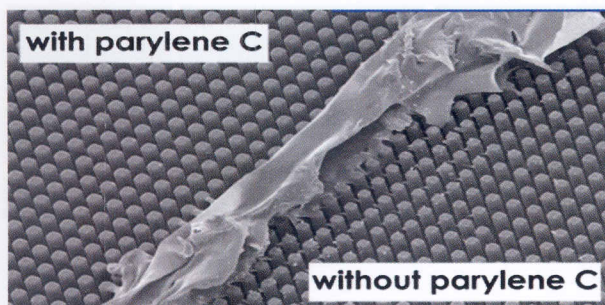


Rapid purification of cell encapsulated hydrogel beads from oil phase to aqueous phase in a microfluidic device

Yuliang Deng, Nangang Zhang, Libo Zhao, Xiaolei Yu, Xinghu Ji, Wei Liu, Shishang Guo,* Kan Liu* and Xing-Zhong Zhao*

We demonstrate a new type of microfluidic chip that can realize continuous flow purification of hydrogel beads from a carrier oil into aqueous solution by using a laminar-like oil/water interface.

4122



Parylene C coating for high-performance replica molding

Kevin A. Heyries and Carl L. Hansen*

Poly(chloro-*p*-xylylene) (parylene C) coating promotes mold release for enhanced master durability and high-performance soft lithography.