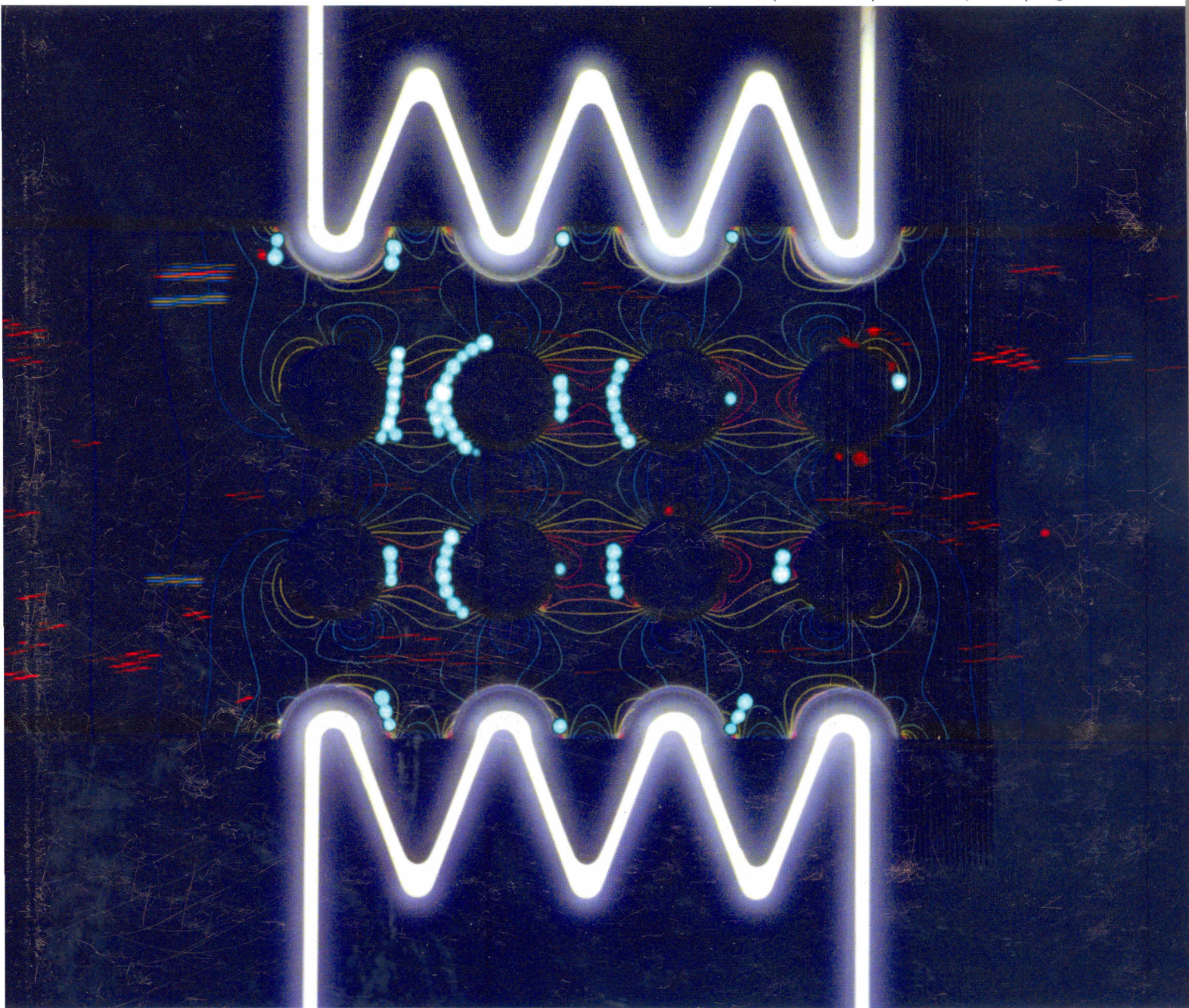


Lab on a Chip

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

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Volume 10 | Number 4 | 21 February 2010 | Pages 397–528



ISSN 1473-0197

RSC Publishing

Davalos *et al.*
Cell isolation with cDEP

Pang *et al.*
Color optofluidic microscope

Celebrating
10
Years of publishing



1473-0197(2010)10:4;1-D

Lab on a Chip

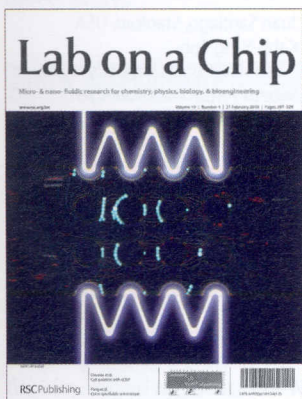
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IN THIS ISSUE

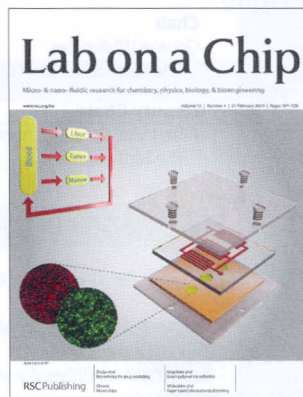
ISSN 1473-0197 CODEN LCAHAM 10(4) 397–528 (2010)



Cover

See Davalos *et al.*, pp. 438–445. Contactless dielectrophoresis (cDEP): an elegant and simple methodology for cell/micro-particle isolation and enrichment. Two microfluidic devices demonstrate the potential of cDEP technology through the separation of live/dead THP-1 human cells.

Image reproduced by permission of Rafael V. Davalos from *Lab Chip*, 2010, **10**, 438.



Inside cover

See Shuler *et al.*, pp. 446–455. A pumpless body-on-a-chip system with 3-D hydrogel cell cultures is combined with a mathematical model to provide a human surrogate for drug-toxicity testing. Image reproduced by permission of Michael L. Shuler from *Lab Chip*, 2010, **10**, 446.

HIGHLIGHT

409

Research Highlights

Petra S. Dittrich*

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



COMMUNICATIONS

411

Implementation of a color-capable optofluidic microscope on a RGB CMOS color sensor chip substrate

Shuo Pang,* Xiquan Cui, John DeModena, Ying Min Wang, Paul Sternberg and Changhui Yang

This communication reports the implementation of a color-capable on-chip lensless microscope system, color optofluidic microscope (color OFM). The imaging of double stained *C. elegans* with lacZ expression by the color OFM demonstrates its potential in on-chip phenotype analysis applications.

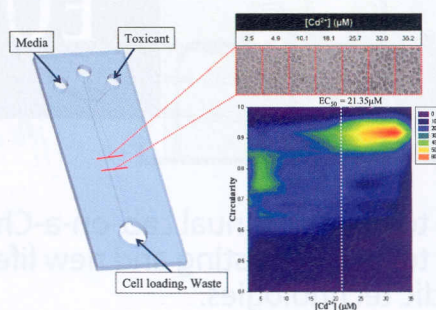


415

Morphology-based assessment of Cd²⁺ cytotoxicity using microfluidic image cytometry (μFIC)

Min Jung Kim, Kook Hee Lim, Hyun Ju Yoo, Seog Woo Rhee and Tae Hyun Yoon*

Morphology-based microfluidic image cytometry (μFIC) was developed and presented here as a simple, efficient, and label-free *in situ* method for quantifying the progress of a cell death event, which can be adapted to HTS platforms for various *in vitro* cell-based assays.



CRITICAL REVIEW

418

Integration and detection of biochemical assays in digital microfluidic LOC devices

Lidija Malic, Daniel Brassard, Teodor Veres* and Maryam Tabrizian*

This paper reviews the state of the art of the EWOD LOC device coupling and integration with analytical detection technologies for biomedical applications. Miniaturized and integrated systems are highlighted to describe current trends and future outlook into the direction of research in this exciting field.



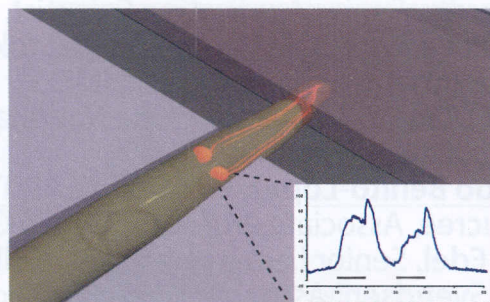
FRONTIERS

432

Worm chips: Microtools for *C. elegans* biology

Nikos Chronis

Here, we discuss the applications, capabilities and future directions of a new family of worm manipulation tools: the worm chips.



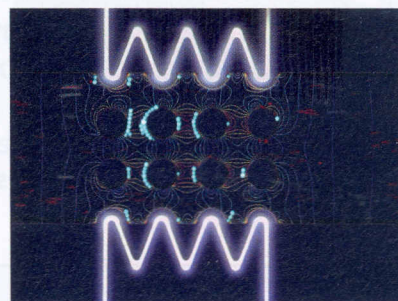
PAPERS

438

Selective isolation of live/dead cells using contactless dielectrophoresis (cDEP)

Hadi Shafiee, Michael B. Sano, Erin A. Henslee, John L. Caldwell and Rafael V. Davalos*

Contactless dielectrophoresis (cDEP) is a recently developed method of cell manipulation in which the electrodes are physically isolated from the sample. Here we present two microfluidic devices capable of selectively isolating live human leukemia cells from dead cells utilizing their electrical signatures.

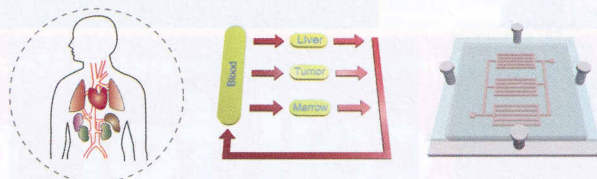


446

A microfluidic device for a pharmacokinetic–pharmacodynamic (PK–PD) model on a chip

Jong Hwan Sung, Carrie Kam and Michael L. Shuler*

This article demonstrates for the first time the combination of a microfluidic system (*in vitro*) with a mathematical PK–PD (*in silico*) model to quantitatively analyze the drug's effect.

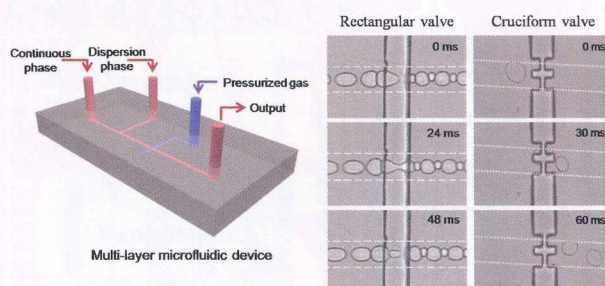


456

Designed pneumatic valve actuators for controlled droplet breakup and generation

Jae-Hoon Choi, Seung-Kon Lee, Jong-Min Lim, Seung-Man Yang* and Gi-Ra Yi*

The dynamic breakup of emulsion droplets was induced in double-layered microfluidic devices equipped with designed pneumatic actuators, in which the droplet breakup mode was significantly affected by the shape and layout of the control valves.

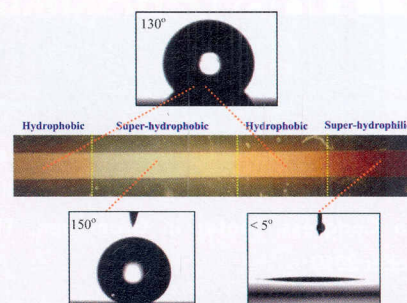


462

“Smart” polymeric microfluidics fabricated by plasma processing: controlled wetting, capillary filling and hydrophobic valving

Katerina Tsougeni, Dimitris Papageorgiou, Angeliki Tserepi and Evangelos Gogolides*

A planar technology using direct lithography on the polymer surface, followed by deep oxygen plasma etching and selective deposition, is proposed as an alternative method for “smart” polymeric microfluidic fabrication.

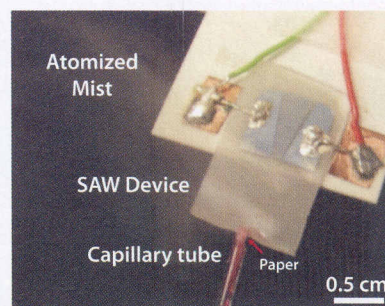


470

The extraction of liquid, protein molecules and yeast cells from paper through surface acoustic wave atomization

Aisha Qi, Leslie Yeo, James Friend* and Jenny Ho

Paper-based microfluidics are enhanced by extraction and atomization of fluids from paper at will using surface acoustic wave irradiation. Large, biologically significant proteins like BSA and ovalbumin and yeast cells tolerate the process with insignificant damage.

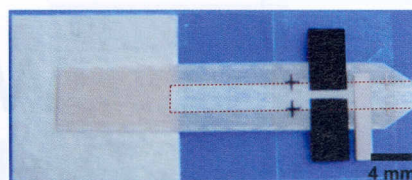


477

Electrochemical sensing in paper-based microfluidic devices

Zhihong Nie, Christian A. Nijhuis, Jinlong Gong, Xin Chen, Alexander Kumachev, Andres W. Martinez, Max Narovlyansky and George M. Whitesides*

This paper describes the fabrication and the performance of microfluidic paper-based electrochemical sensing devices that are capable of quantifying the concentrations of various analytes (*e.g.*, heavy-metal ions and glucose) in aqueous solutions.

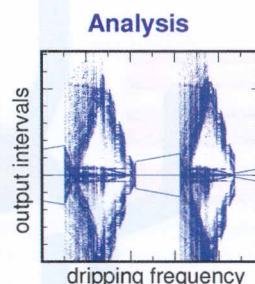
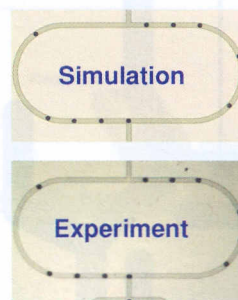


484

Dynamic memory in a microfluidic system of droplets traveling through a simple network of microchannels

Olgierd Cybulski* and Piotr Garstecki*

The flow of droplets through a simple microfluidic network of channels exhibits stable temporal sequences of trajectories of droplets that can be switched between each other with a transient stimulus.

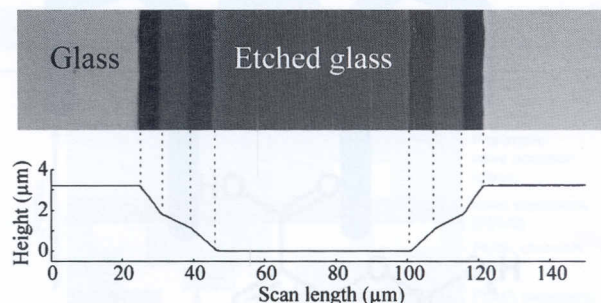


494

Wet-etching of structures with straight facets and adjustable taper into glass substrates

Nikola Pekas, Qing Zhang, Matthieu Nannini and David Juncker*

We present a simple wet-etch process based on a single masking step for the fabrication of microchannels in glass with straight, tapered sidewalls with a defined angle by controlling the lateral etch rate of a sacrificial mask. Multi-faceted sidewalls can also be made by varying the lateral etch rate during the process.

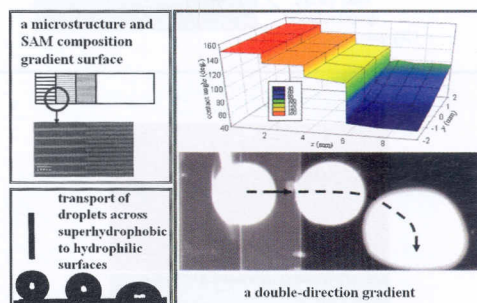


499

A microchip fabricated with a vapor-diffusion self-assembled-monolayer method to transport droplets across superhydrophobic to hydrophilic surfaces

Yu-Hsuan Lai, Jing-Tang Yang* and Dar-Bin Shieh*

We propose an approach that combines a structure gradient and a self-assembled-monolayer (SAM) gradient to fabricate a microchip to transport a biochemical droplet across superhydrophobic to hydrophilic surfaces.

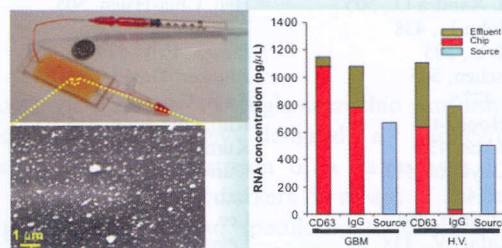


505

Microfluidic isolation and transcriptome analysis of serum microvesicles

Chihchen Chen, Johan Skog, Chia-Hsien Hsu, Ryan T. Lessard, Leonora Balaj, Thomas Wurdinger, Bob S. Carter, Xandra O. Breakefield, Mehmet Toner and Daniel Irimia*

This article describes a rapid microfluidic immunoaffinity method to isolate microvesicles (exosomes) that carry proteins, lipids and nucleic acids derived from the host cell. RNA of high quality can be extracted from these microvesicles providing a source of information about the genetic status of tumors to serve as biomarkers for diagnosis and prognosis of cancer.

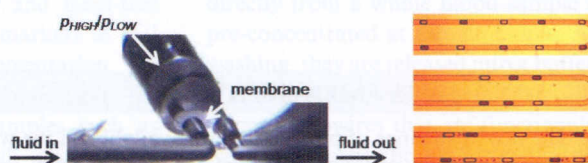


512

Droplet on demand system utilizing a computer controlled microvalve integrated into a stiff polymeric microfluidic device

Krzysztof Churski, Jacek Michalski and Piotr Garstecki*

An integrated microvalve compatible with polymeric and glass microfluidic devices allows for formation of droplets and bubbles on demand.



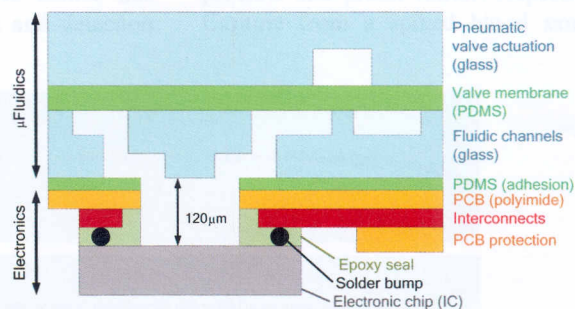
TECHNICAL NOTES

519

Modular integration of electronics and microfluidic systems using flexible printed circuit boards

Amy Wu, Lisen Wang, Erik Jensen, Richard Mathies and Bernhard Boser*

A modular approach for embedding integrated electronic circuits with microfluidic systems is presented. The subsystems are developed and optimized independently using standard fabrication techniques and bonded with a PDMS adhesion layer.



522

Rapid, cost-efficient fabrication of microfluidic reactors in thermoplastic polymers by combining photolithography and hot embossing

Jesse Greener, Wei Li, Judy Ren, Dan Voicu, Viktoriya Pakharensko, Tian Tang and Eugenia Kumacheva*

We report a cost-efficient process for producing microfluidic reactors in thermoplastic materials by (i) fabricating an imprint template which consist of a patterned photoresist deposited on a metal plate; (ii) thermoembossing of the template features into a polymer sheet; and (iii) low-temperature sealing of the embossed sheet and a planar thermoplastic sheet.

