Materials and Strategies for Lab-on-a-Chip — Biological Analysis, Cell-Material Interfaces and Fluidic Assembly of Nanostructures
Materials and Strategies for Lab-on-a-Chip — Biological Analysis, Cell-Material Interfaces and Fluidic Assembly of Nanostructures

Symposium held April 14–17, 2009, San Francisco, California, U.S.A.

EDITORS:

Shashi K. Murthy  
Northeastern University  
Boston, Massachusetts, U.S.A.

Saif A. Khan  
National University of Singapore  
Singapore

Victor M. Ugaz  
Texas A&M University  
College Station, Texas, U.S.A.

Henry C. Zeringue  
University of Pittsburgh  
Pittsburgh, Pennsylvania, U.S.A.

Materials Research Society  
Warrendale, Pennsylvania
Preface ............................................................................................................................................. ix

Materials Research Society Symposium Proceedings ........................................................................... x

*FRONTIERS IN LAB-ON-A-CHIP RESEARCH*

* Microfluidic Manifolds with High Dynamic Range in Structural Dimensions Replicated in Thermoplastic Materials ................................................................................................................................. 3
  Holger Becker, Erik Beckert, and Claudia Gartner

* Tetherless, 3D, Micro-Nanoscale Tools and Devices for Lab-on-a-Chip Applications ................................................. 9
  David Gracias

*POSTER SESSION: MATERIALS FOR LAB ON A CHIP*

Hot Embossing of Microchannels in Cyclic Olefin Copolymer ........................................................................... 17
  Patrick W. Leech

Biohybrid Photoelectrochemical Nanoengineered Interfaces .............................................................................. 23
  Arati Sridharan, Jit Muthuswamy, and Vincent B. Pizziconi

*MATERIALS SYNTHESIS ON CHIP*

Microfluidic Channel Fabrication in Dry Film Resist for Droplet Generation .................................................. 31
  Patrick W. Leech, Nan Wu, and Yonggang Zhu

*Invited Paper*
CELL MANIPULATION AND BIOMIMETICS ON CHIP

The Normal and Shear Strength of the Cell-Implant Interface: Accelerated Negative Buoyancy as a Method of Cell Adhesion Assessment ................................................................. 39
Helen J. Griffiths, Charles A. Collier, and T.W. Clyne

Artificial Cilia: Mimicking Nature Through Magnetic Actuation ......................................................... 45
Syed Khaderi, Michiel Baltussen, Patrick Anderson, D. Ioan, Jaap den Toonder, and Patrick Onck

ADVANCES IN DEVICE MATERIALS

Lab-on-Glass System for DNA Analysis Using Thin and Thick Film Technologies ........................................ 53
Domenico Caputo, Matteo Ceccarelli, Giampiero de Cesare, Augusto Nascetti, and Riccardo Scipinotti

Self-Assembled Ultra-Thin Silica Layers for On-Chip Chromatography ................................................. 59
Sun Choi, Inkyu Park, and Albert P. Pisano

ADVANCES IN INTEGRATING DEVICE COMPONENTS

The MAESFLO Device: A Complete Microfluidic Control System ......................................................... 67
Jacques Goulpeau, Velan Taniga, and Charles-André Kieffer

Miniaturization of Immunoassays Using Optical Detection with Integrated Amorphous Silicon Photodiodes ................................................................. 73
Ana T. Pereira, Virginia Chu, Duarte M. Prazeres, and Joao Conde
Miniaturized Silicon Apertures for Lipid Bilayer Reconstitution Experiments
Michael Goryll and Nipun Chaplot

Efficient Nanoporous Silicon Membranes for Integrated Microfluidic Separation and Sensing Systems
Nazar Ileri, Sonia E. Létant, Jerald Britten, Hoang Nguyen, Cindy Larson, Saleem Zaidi, Ahmet Palazoglu, Roland Faller, Joseph W. Tringe, and Pieter Stroeve

Direct FIB Fabrication and Integration of "Single Nanopore Devices" for the Manipulation of Macromolecules
Birgitta Schiedt, Loic Auvray, Laurent Bacri, Anne-Laure Biance, Eric Bourhis, Ali Madouri, Gilles Patriarche, Juan Pelta, Ralf Jede, and Jacques Gierak

Inkjet Printing of Enzymes for Glucose Biosensors
Christopher Cook, TianMing Wang, and Brian Derby

Study of Biosensors Based on Fe Nanowires
Yang Hao and Chen Yuquan

Doped ZnO Colloids for Cancer Detection — Bio-Imaging and Cytotoxicity Study
Linda Y. Wu, June Loh, Sheng Fu, Alfred I. Tok, Xianting Zeng, Leong C. Kwek, and Freddy Y. Boey
Screen-Grid Field Effect Transistor for Sensing Bio-Molecules

Kwee G. Eng, Kristel Fobelets, and Enrique Velazquez-Perez

Resonant Microcavities Coupled to a Photonic Crystal Waveguide for Multi-Channel Biodetection

Elisa Guillermain and Philippe M. Fauchet

SENSING AND DETECTION ON CHIP — DNA

Phosphate-Dependent DNA Immobilization on Hafnium Oxide for Bio-Sensing Applications

Nicholas Fahrenkopf, Serge Oktyabrsky, Eric Eisenbraun, Magnus Bergkvist, Hua Shi, and Nathaniel C. Cady

Author Index

Subject Index
PREFACE

This volume is a collection of papers presented at Symposium OO, “Materials and Strategies for Lab-on-a-Chip — Biological Analysis, Cell-Material Interfaces and Fluidic Assembly of Nanostructures,” held April 14–17 at the 2009 MRS Spring Meeting in San Francisco, California.

The development of miniaturized systems for chemical and biochemical analysis has grown and matured to the point where lab-on-a-chip devices are now important enabling tools in a diverse array of application areas. But as the size of these systems continues to shrink, details of the micro- and nano-scale phenomena associated with their construction and operation must be considered. This symposium addressed these challenges by assembling a unique and vibrant collection of speakers who presented multidisciplinary research at the interface between materials science, biology, chemistry, and engineering.

We are grateful to all of the contributors and participants who made this four-day symposium highly successful. We gratefully acknowledge financial support from Microfluidic ChipShop GmbH and Northeastern University.

Shashi K. Murthy
Saif A. Khan
Victor M. Ugaz
Henry C. Zeringue

August 2009
MATERIALS RESEARCH SOCIETY SYMPOSIUM PROCEEDINGS


Prior Materials Research Society Symposium Proceedings available by contacting Materials Research Society