



Nano and Microstructured Systems

G. Barillaro

Information Engineering Department

University of Pisa



Nano/MicroStructuring for (Bio)Sensing Applications

Giuseppe BARILLARO

Dipartimento di Ingegneria dell'Informazione

Università di Pisa

Tel. 050 2217 601

email: g.barillaro@iet.unipi.it

Website: www.iet.unipi.it/g.barillaro

**FUTURO
IN RICERCA**



**REGIONE
TOSCANA**



**fondazione
c a r i p l o**

life.augmented

On-Going Projects:

STMICROELECTRONICS 2013: Porous Silicon for Industrial Applications funded by STMicroelectronics (2013-2016)

FIRB 2012 (Futuro in Ricerca): Ultra-Sensitive Flow-Through Optofluidic MicroResonators for Biosensing Applications funded by MIUR (2013-2016)

CARIPO 2012: Three-dimensional silicon microstructures for label- free detection of circulating tumor cells by optical tomography, funded by Fondazione CARIPO (2012-2014)

PRIN 2010: ARTEMIDE (Autonomous Real Time Embedded Multi-analyte Integrated Detection Environment): lab-on-chip totalmente integrato per la diagnosi precoce di infezioni virali funded by MIUR (2013-2016)

REGIONE TOSCANA 2009: A minimally Invasive Microsystem for Glucose Monitoring in Diabetic Patients, funded by Regione Toscana (National Health Research Program) (2010-2013)

...others



Collaboration in Italy and Abroad



SAPIENZA
UNIVERSITÀ DI ROMA



**Massachusetts
Institute of
Technology**

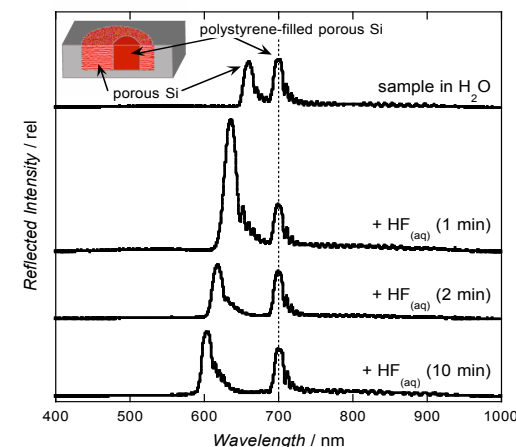
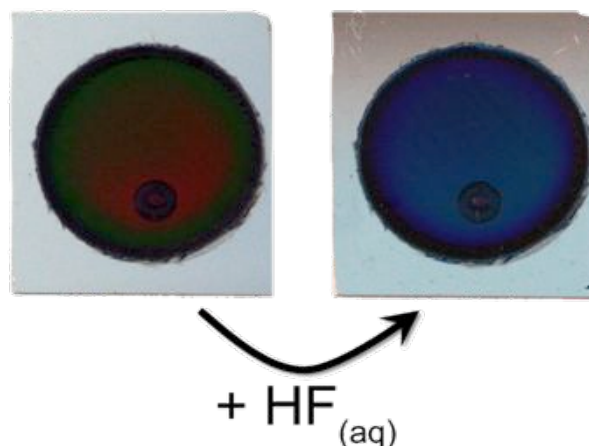
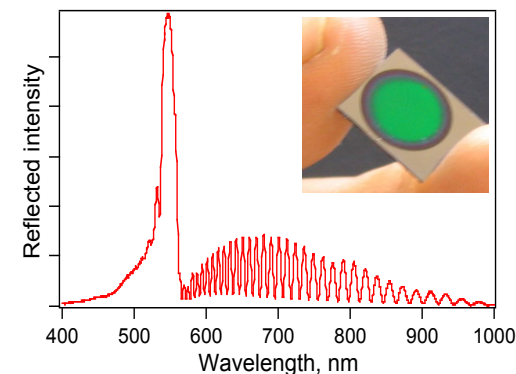
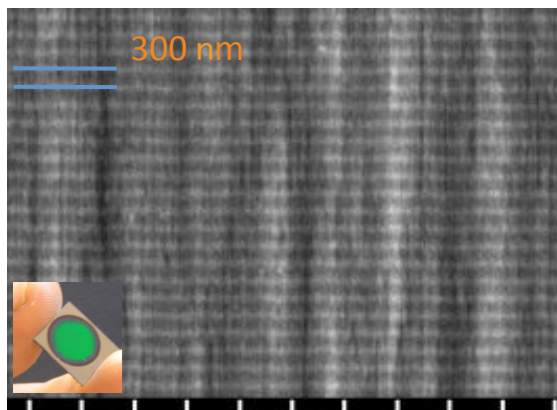


**Nano and Micro structuring Makes
Silicon Doing Funny Things**

Nanostructured Photonic Crystal Optical Filters and (Bio)Sensors

A. Ruminski, G. Barillaro, .., M. J. Sailor, *Advanced Functional Materials* (2011)

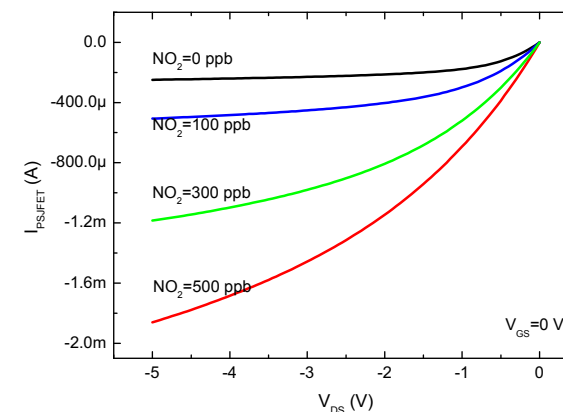
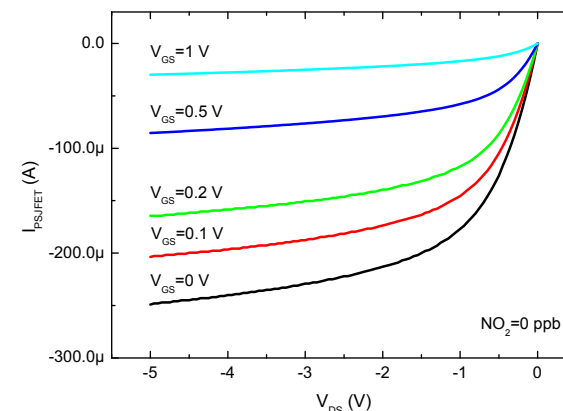
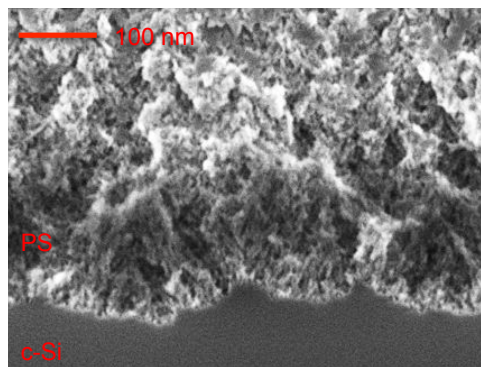
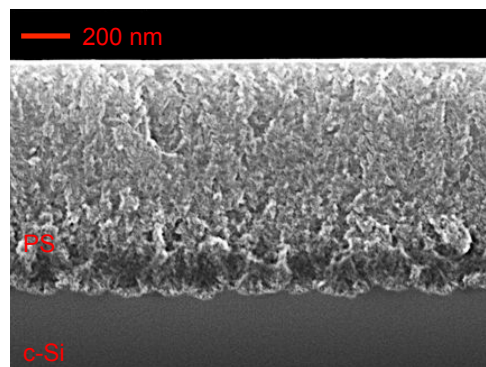
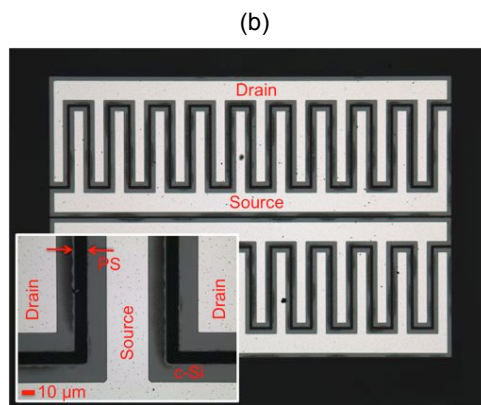
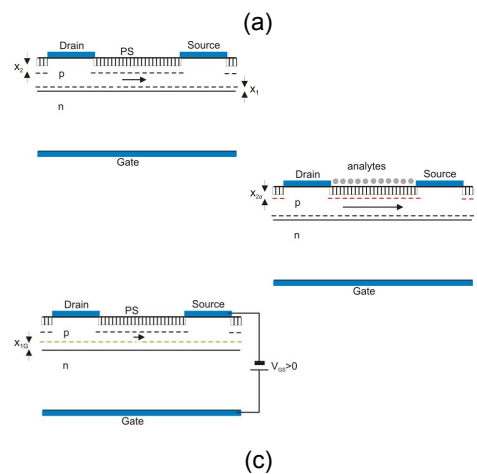
A. Ruminski, G. Barillaro, .., M. J. Sailor, *Advanced Optical Materials* (2013)





Solid-State Integrated Sensors based on Nanostructured Silicon

G. M. Lazzerini, L. M. Strambini, G. Barillaro, *Nature Scientific Reports* (2013)





Integrated Gas Sensing Platforms Based on Nanostructured Silicon

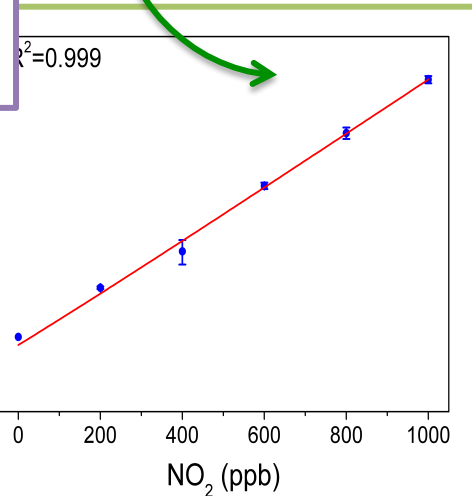
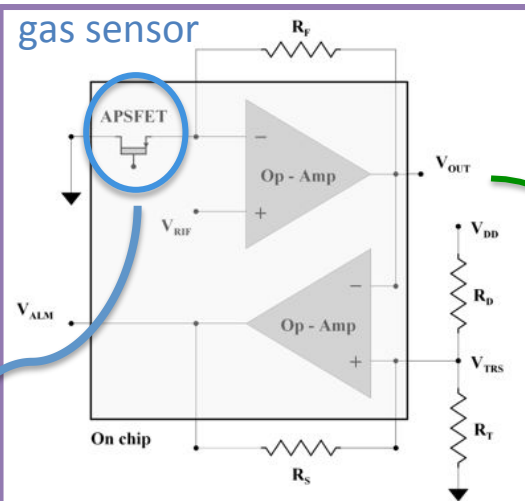
G. Barillaro, L. M. Strambini, *Sensors Actuators B* (2008)

G. Barillaro et al., *Physica Status Solidi (a)* (2007)

Gas Sensing Platform by Bipolar-CMOS-DMOS (BCD) 0.35 μm process of STMicroelectronics

No additional steps were included in the CMOS flow

Nanostructured silicon by post-processing

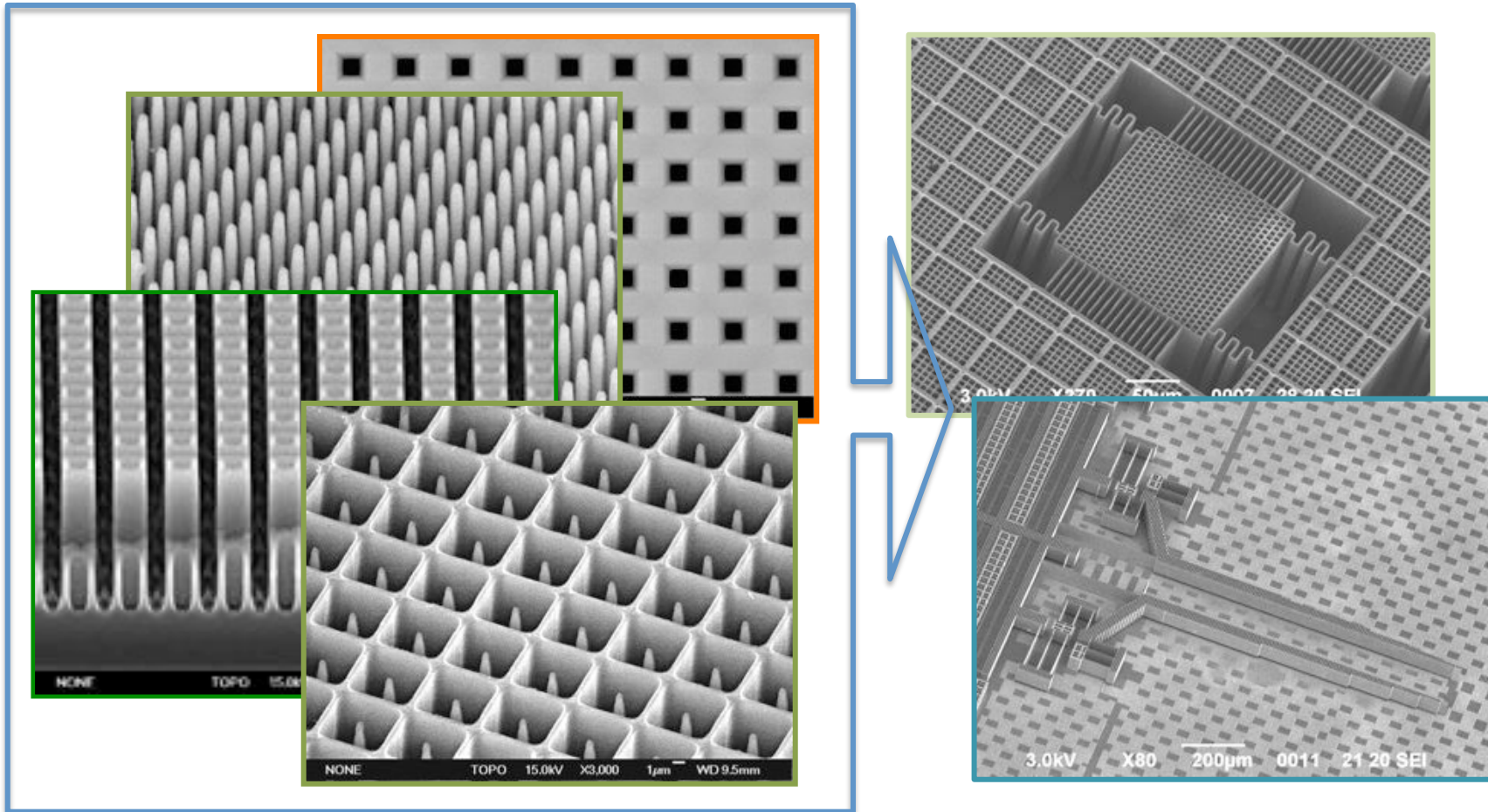


on-chip electronics



Electrochemical Micromachining for Advanced Silicon Microstructuring

M. Bassu, S. Surdo, L. M. Strambini, G. Barillaro, *Advanced Functional Materials* (2012)





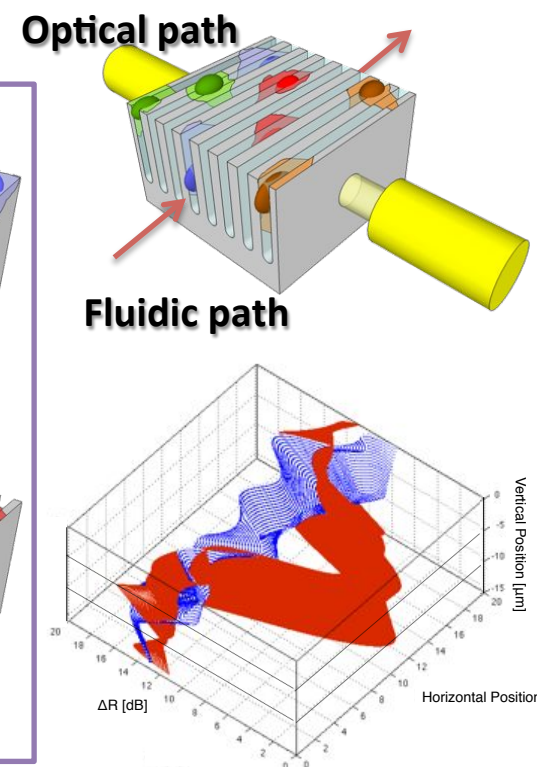
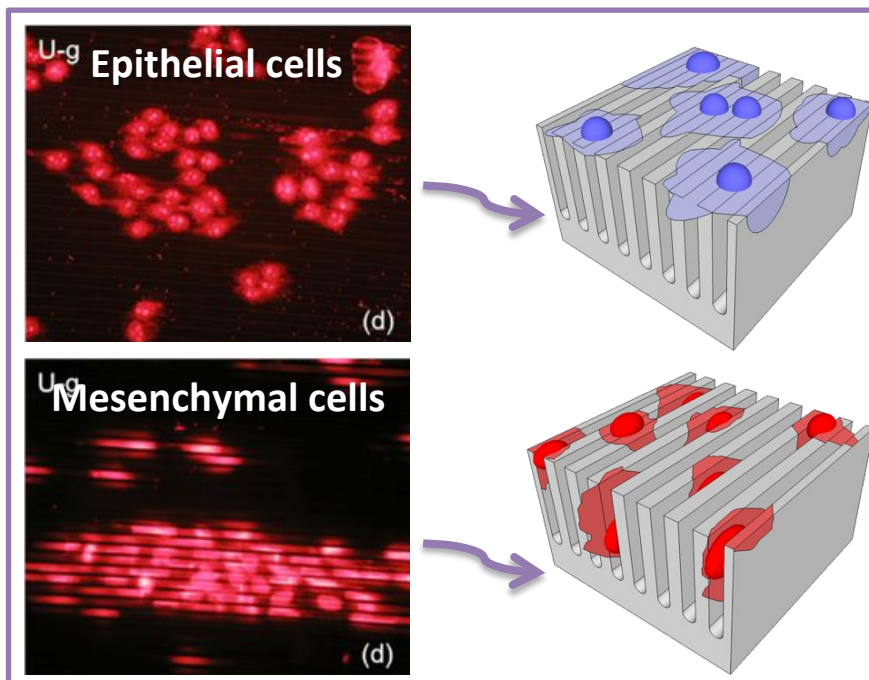
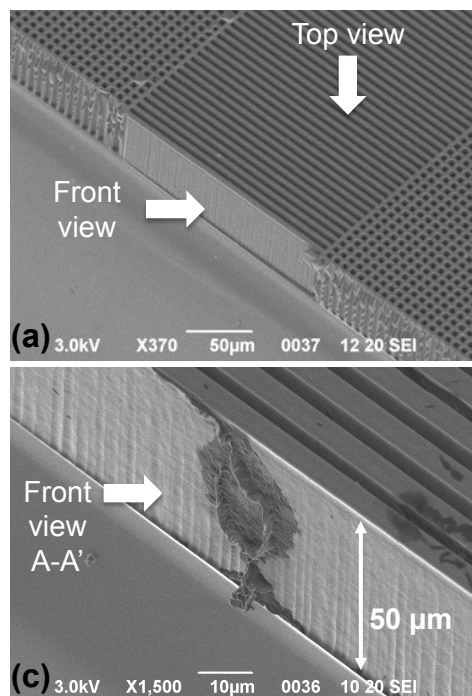
3D cell culturing into silicon photonic crystals for cell-based biosensors

F. Carpignano,..., S. Merlo, G. Barillaro, G. Mazzini, *PlosONE* (2012)

S. Merlo,... G. Mazzini, G. Barillaro, *Lab on a Chip* (2013)

Epithelial cells: SW613-B3; HeLa; SW480; HCT116; HT29

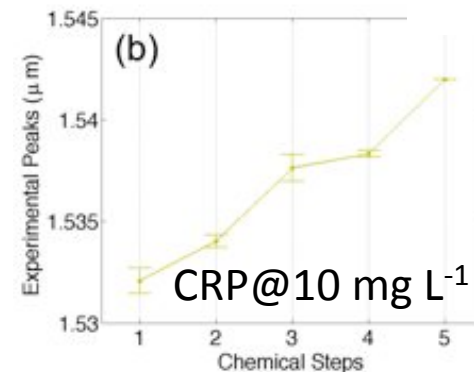
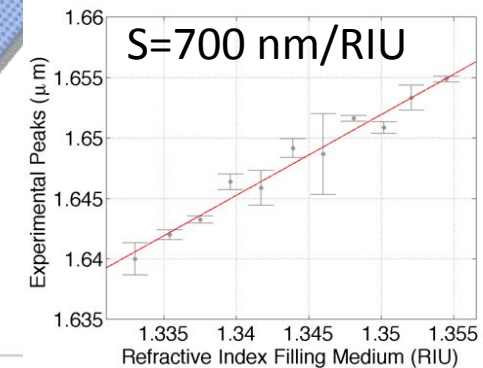
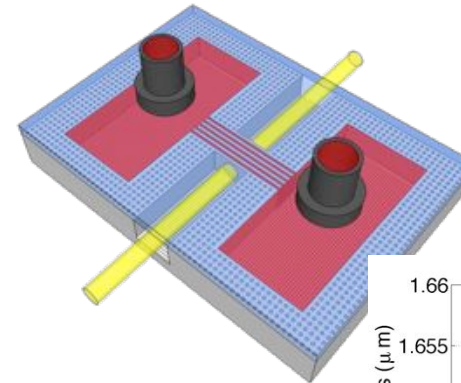
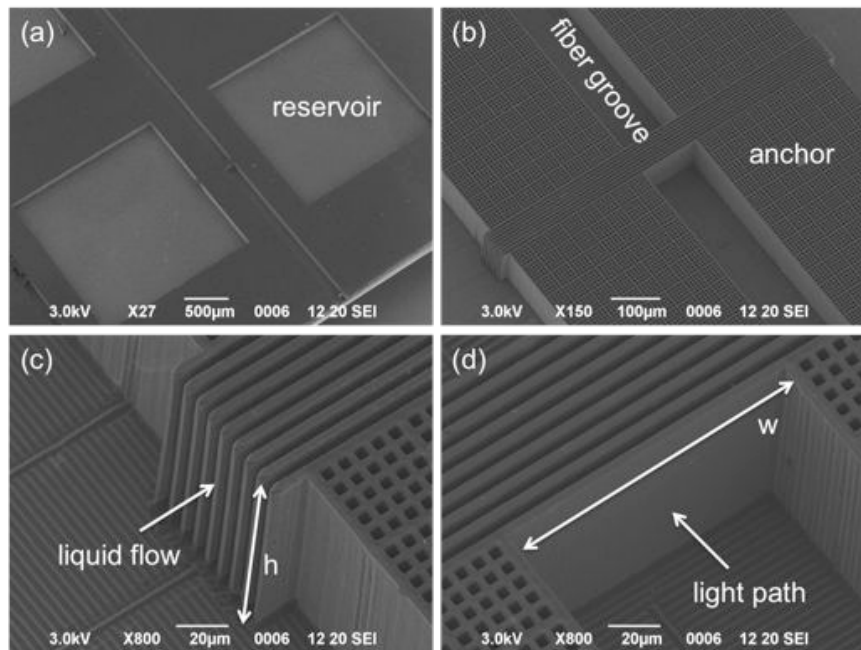
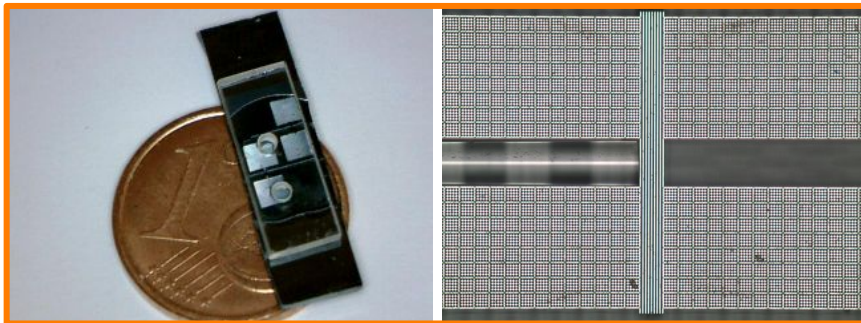
Mesenchymal cells: MRC-5V1; CF; HT1080





Photonic Crystal Microsystems for Optofluidic/Biosensing Applications

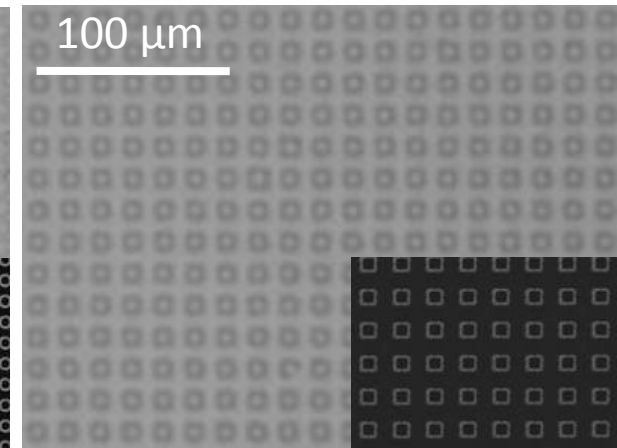
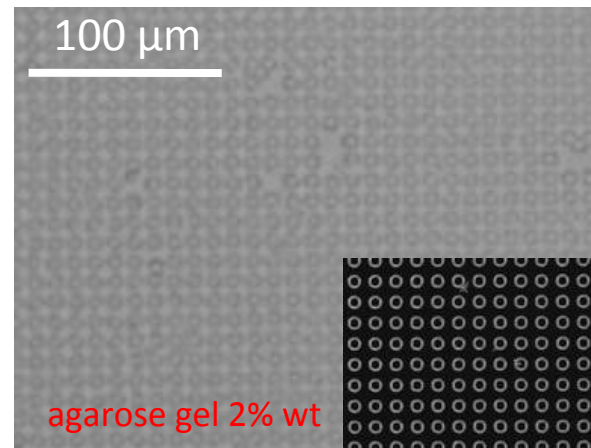
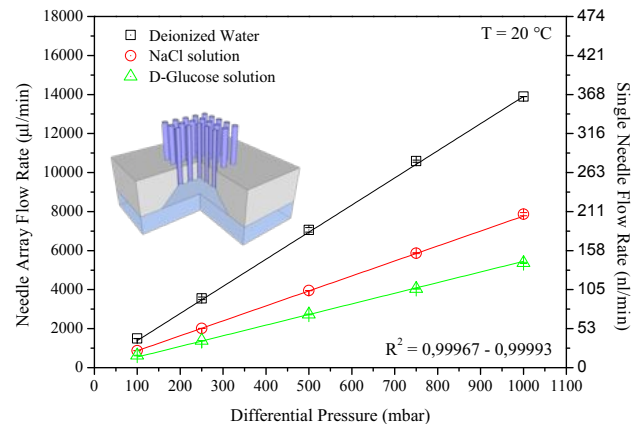
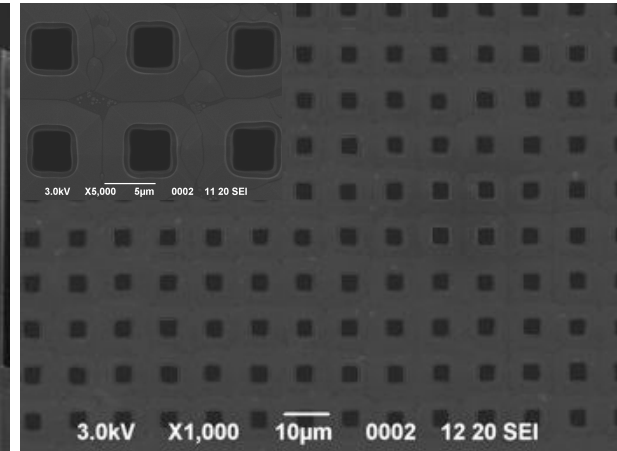
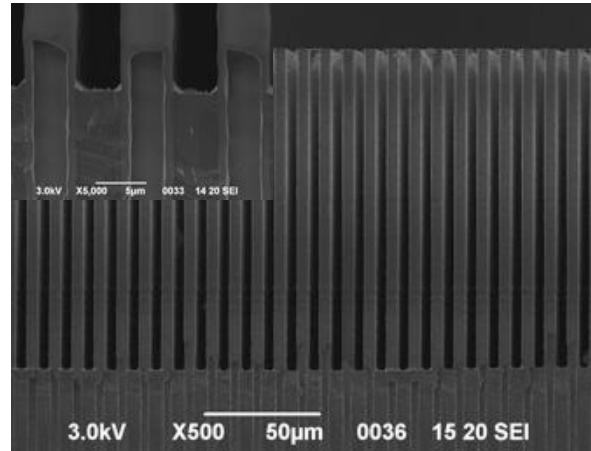
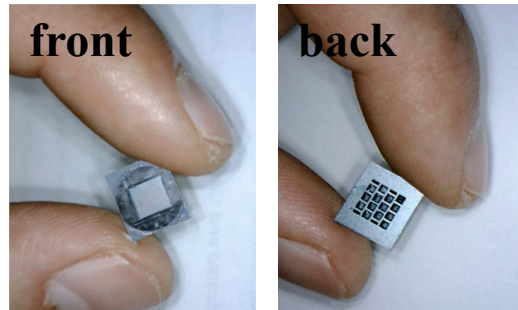
S. Surdo, S. Merlo, F. Carpignano, L. M. Strambini, C. Trono, A. Giannetti, F. Baldini, G. Barillaro, *Lab on Chip*, (2012)





Microneedles for Transdermal Delivery/ Sampling Painless Applications

L. M. Strambini, A. Longo, A. Diligenti, G. Barillaro, *Lab on a Chip* (2012)





THANKS FOR YOUR ATTENTION