Contenu archivé le 2024-06-18

Microsystems and Bioanalysis Platforms for Health Care MICROCARE

Rapports

Informations projet

MICROCARE

N° de convention de subvention: 247641

Site Web du projet

Projet clôturé

Date de début
1 Juillet 2010

Date de fin
30 Juin 2014

Financé au titre de
Specific programme "People" implementing the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007 to 2013)

Coût total
€ 669 600,00

Contribution de l'UE
€ 669 600,00

Coordonné par
SCIENCE AND TECHNOLOGY FACILITIES COUNCIL
United Kingdom

Ce projet apparaît dans...

MAGAZINE RESEARCH*EU

Quand la science s'allie à la sécurité

N° 44, JUILLET 2015

Final Report Summary - MICROCARE (Microsystems and Bioanalysis Platforms for Health Care MICROCARE)

Miniaturisation of analytical systems is generally considered to be the strategy that will overcome the requirements of process speed for performing efficient evaluation studies. By utilising the versatility of silicon micromachining to fabricate efficient minute volume microstructures, it is possible to make analysis systems that are extremely small. The benefits of miniaturisation stem from the increased reaction kinetics in low volumes and the possibility to perform sample-handling procedures at a high speeds.
MICROCARE's research activities were focussed on the implementation of micro/nano fabrication technologies for functionalised systems and sensors for bio-chemical analysis and micro delivery.
Research institutes from Europe and China were involved in the MICROCARE project. Through the exchange of researchers (seconded to Chinese collaboration partners or visiting scientists from China to the European project partners), the transfer of knowledge, the interaction and research collaboration in the field of Microelectromechanical Systems (MEMS) technology and micro-fluidic devices with the particular focus on bio-functionality was encouraged.
Teams of the French University Ecole Normale Superieure (ENS) and Peking University (PKU), together with Queen Mary and Westfield College - University of London (QMUL) and Fudan University in China (FDU) have been mainly working on fabrication and integration of micro-patterns into microfluidic devices for cell biology studies. In particular, these teams have developed new types of scaffolds for tissue engineering and microfluidic devices for diagnosis of tumour cells and a variety of chemo- and biosensors for oxygen, glucose and lactate monitoring. Such sensors are also suitable for understanding chemical signalling in cells. These are all important precursors to develop more complex platforms controlling cell regulation by chemical signalling.
At the Westfälische Wilhelms-Universität Münster (MUE) in Germany, efforts on functionalised systems and sensors for bio-chemical analysis and micro delivery were based on micro-transducer array and micro-machined modules. MUE developed micro-fluidic devices, surface structuring and chemical organization methods to study both synthetic and systems biology. In collaboration with Institute of Electronics - Chinese Academy of Science (IECAS), studies focused on fabrication of micro-nanopatterns and their influence on cell behaviours (e.g. cell differentiation, growth and alignment). Functionalized surfaces with selective patterning of bio-related materials and functional molecules were developed.
The Science and Technology Facilities Council (STFC) in the UK contributed to the design of microfluidic channels and developed novel nanoimprint lithography techniques for the manufacture of micro/nano

pattern integrated in microfluidic channels. The feasibility of such fabrication techniques were tested in strong collaboration with FDU in China.
The main objectives of the MICROCARE project were the implementation of micro/nano fabrication technologies for functionalised systems and sensors for bio-chemical analysis and micro delivery based on microtransducer array and micromachined modules. Particular achievements of the project were the demonstration of combined techniques such as near-field optical lithography (NFOL) and nanoimprint lithography (NIL) for nanopatterning. Materials such as PEDOT:PSS as well as ferroelectric PZT and P(PVD-TrFE) were identified as materials for device fabrication. Where applicable, tests to control the wettability, adhesion, photonic or electric properties of bio-specific materials of such materials and devices were carried out. Designated devices were also integrated with video microscopy platforms suitable for three-dimensional imaging or spectroscopy.
Micro-patterned microfluidic devices for cell biology studies were achieved which allowed observing topographic and biochemical cues for cell alignment and cell cultures by utilizing nanopatterned gelatine, multi-electrode monitoring of guided excitation in patterned cardiomyocytes, or localized cell stimulation by nitric oxide using a photoactive porous coordination polymer platform.
Employing novel protocols of microfluidic based cell adhesion and cell migration assays, the microfluidic capture of endothelial progenitor cells in human blood samples was accomplished.
Rolling methods for fabricating ferroelectric channels emerged and electrospinning of ultra-fine piezoelectric fibres were developed which potentially will have applications for novel microfluidics devices.
Hot-embossing for nanopatterning ferroelectric PZT and P(PVD-TrFE) thin films for bioengineering and sensing applications was also established.
Among a variety of nano/microstructures, superhydrophobic patterns with reversible wettability and adhesion for in situ surface modification were developed including bioinspired TiO_2 nanostructure films with special wettability and adhesion for droplets manipulation and patterning. 3D patterned superamphiphobic ATP films were demonstrated.
Nanophotonics was used in combination with microfluidic pattern for sensor technology; re-oriented and selective growth of ZnO nanowires and enhanced hydrophobicity was demonstrated; metallic photonic crystal based SPR biosensor were developed.
Soft lithography was used for protein patterning; surface structuring was carried out using Atomic Force Microscopy or Electron Beam Lithography. Such surfaces are practical for controlling cell growth, cell differentiation, adhesion, and migration. For instance, a membrane microfluidics systems which can be used for allowing reagents and nutrients needed for cell growth to be supplied from one side of the membrane to the other in a more controlled and reproducible manner than that often found in traditional cell culture technologies was established.
Chemosensors and biosensors based on polyelectrolyte microcapsules containing fluorescent dyes and enzymes were developed. Arrays of nanotubes were demonstrated as versatile platform for biomedical applications and dry-release techniques for nanotubes were investigated utilizing these methods for novel biosensors. High-sensitivity photodetection sensor front-end for detecting organophosphourous compounds in food safety and in vivo sensors for oxygen, glucose and lactate monitoring resulted also from these studies.
A large variety of novel techniques and sensor devices were developed in the MICROCARE project which addresses in particular biomedical, biochemical, and cell applications. Miniaturized biosensors will make the healthcare more efficient and reliable. Moreover, individual patients may benefit from such devices using those at home for their personal health needs (e.g. improved glucose sensors for diabetes patients).

Some of the novel sensors may help in detecting diseases or may assist in the development of new drugs and medication – in particular for the study of diseases on cell and molecular level. Further, the MICROCARE project supported the global interaction between European and Chinese research centres in the field of micro/nano engineering of chemo- and biosensors from which the global biomedical research will benefit.

Dernière mise à jour: 11 Février 2015

Permalink: https://cordis.europa.eu/project/id/247641/reporting/fr