

Curriculum Vitae

Personal Information:

Family Name, First Name: TSOUGENI, KATERINA

Gender: Female

Marital Status: Married, one child

Education:

- **PhD:** 2010, National and Kapodistrian University of Athens, Department of Chemistry, Greece, and Institute of Microelectronics, NCSR Demokritos, Aghia Paraskevi Greece, (supervisor Dr. Evangelos Gogolides), Doctor of Philosophy (Ph.D.), Thesis title: “Micro and Nano Modification of Polymers for the Fabrication of Polymeric Microanalytical Devices” Grade: Excellent (10).
- **M.Sc.:** 2005, National and Kapodistrian University of Athens, Department of Chemistry, Greece, and Institute of Microelectronics, NCSR Demokritos, Aghia Paraskevi Greece, (supervisor Dr. Evangelos Gogolides), Master’s Degree, in Polymers Science and Applications, Thesis title: “Modification of Polydimethylsiloxane Surfaces in Plasma Discharges” Grade: Excellent (10).
- **B.Sc.:** 2003, Petroleum and Natural Gas Chemistry and Technology, Technological Educational Institute of Kavala, Department of Petroleum Chemistry, Greece, Bachelor Degree.

Current Position:

- 1) **2016-present**, *Nanoplasmas Private Company, Spin-off company of NCSR Demokritos*, Aghia Paraskevi, Attiki, Greece. Nanoplasmas is operating in the rapidly developing field of life sciences, preparing high-end consumables for diagnostic applications: 1) 3D Microarrays, 2) Cell culture surfaces / petri dishes, 3) Microfluidics. Nanoplasmas pioneered a generic biomolecule capture platform for DNA, proteins and antibodies: “The Nanotextured 3D substrates”.

Main activities:

- Product development manager, expertise in Microarrays and Microfluidic devices

Role: **Cofounder and product development manager**

Previous Positions:

- 1) **8/2018-7/2021**, fellowship for industrial post-doc position from Stavros Niarchos Foundation and NCSR “Demokritos”.
- 2) **3/2016-7/2018**, **National Center for Scientific Research Demokritos** Institute of Nanoscience and Nanotechnology, Aghia Paraskevi, Attiki, Greece. Post-Doctoral researcher on contract supporting the research European Horizon2020-funded project « LOVEFOOD2Market – A portable MicroNanoBioSystem and Instrument for ultra-fast analysis of pathogens in food: Innovation from LOVE-FOOD lab prototype to a pre-commercial instrument LOVE FOOD-Love wave fully integrated Lab-on-Chip platform for food pathogen detection, Grant Agreement No 687681»
Main activities: Development of novel biochips for bacteria capture and lysis from contaminated food samples
Role: **Postdoctoral scientist**
- 1) **12/2013 – 02/2016**, Post-Doctoral researcher on contract supporting the ICT-FP7 research European program «LOVE FOOD-Love wave fully integrated Lab-on-Chip platform for food pathogen detection» NCSR Demokritos, Institute of Nanoscience and Nanotechnology, Athens, Greece in collaboration with Department of Biology, in FORTH

Crete

Main Tasks:

- Responsible for successful implementation of 2 Work Packages
- Design, fabrication and characterization of a bioanalytical device for enrichment and isolation of DNA of pathogen microorganisms in food.

Role: **Postdoctoral scientist**

- 2) **02/2011 – 11/2013**, Post-Doctoral researcher on contract supporting the European program MiNaSys-Coe, Micro and Nano Systems - Center of Excellence FP7-REGPOT-2009-245940 NCSR Demokritos, Institute of Microelectronics, Athens, Greece

Main Task:

- Lab on chip activities: Patterning and surface modification of thick polymeric resists and polymeric substrates for microfluidics and Labs on a Chip for analytical applications.

Role: **Postdoctoral scientist**

- 3) 07/2010 – 01/2011, National Center for Scientific Research Demokritos, Institute of Microelectronics, Aghia Paraskevi, Attiki, Greece in collaboration with Bioacademy of Athens

Main Task:

- Enrichment and Separation of Phosphopeptides from research grade samples derived from clinical sera and urine specimens using offline MALDI-MS and online LC ESI-MS approaches.

Role: **Research Associate**

- 4) 05/2006 - 03/2010, Ph.D thesis work on contract for the “Micro and Nano Modification of Polymers for the Fabrication of Polymeric Microanalytical Devices” supporting the ICT/NMP2 research European project “Plasma Etching for desired nano-feature shape and nano-texture: An Advanced Reactor and Simulation Software for Feedback-Loop Plasma Control – Nanoplasma” NCSR Demokritos, Institute of Microelectronics, Athens, Greece

Role: **Research Assistant**

- 5) 12/2007 - 03/2008, Research on contract for “Designing of lithographic processes for MEMS” supporting the research program G.G.E.T. 052-e Technological Educational Institute of Athens

Role: **Research Associate**

- 6) 09/2005 - 05/2006, Research on contract for the “Optimization of deposition process and modification thick polymeric substrates for the fabrication of PCB sensors” supporting the research program EPEAEK ARCHIMEDES II Technological Educational Institute of Athens

Role: **Research Associate**

- 7) 04/2002 - 11/2002, Practical Training
Phosphate Fertilizers Industry, Thessaloniki, Greece

Fellowships/Prizes/Awards:

- 1) 2013, 2nd award in Applied Research and Innovation Contest for Excellence "Kainotomeis" with “Smart nanostructured surfaces and bioanalytic labs-on-chip” September 2013.

Supervision of graduate students:

Co-supervision of:

5 MSc students (D. Papageorgiou, K. Kontakis, S. Vorvi, A. Kanioura, Th. Christoforidis), 5 years, Institute of Nanoscience and Nanotechnology, NCSR Demokritos.

1 PhD student (A. Kastania) 3 years, Institute of Nanoscience and Nanotechnology, NCSR Demokritos.

Laboratory teaching:

- 4th, 5th, 6th Nano2life Summer Schools (2008-2010)

(<http://www.imel.demokritos.gr/SummerSchool2007/index.htm>), Methods in Micro-Nanotechnology and Nanobiotechnology, Lab lesson (30h, 3 years) “Fabrication of plastic microfluidic devices by Lithography and deep polymer plasma etching techniques”.

- 1st Summer school CYCLON HIT (2/10/2014) (<http://itn-cyclonhit.eu/>), Nanomaterials for bio-applications: focus on antimicrobial research, Lab lesson (2h) “Bioanalytical microsystems for pathogen detection based on “smart” nanotextured surfaces”.

Career Breaks:

10 – 11/2015 2 months for maternity reasons

Mobility:

06/2009 – 01/2010 Biomedical Research Foundation, Academy of Athens. Task Affinity chromatography for phosphopeptide analysis.

02/2014 – 04/2014 Department of Biology, Task micro- nano- structures for cell capture, Funded by Contract No 317742 LOVE FOOD programme.

07/2014 – 02/2015 Department of Biology, Task evaluation of polymeric Lab on chip for bacteria capture, Funded by Contract No 317742 LOVE FOOD programme.

01/2017 – 02/2017 Institute Pasteur, Paris France, Task Evaluation of Integrated chip appropriate for bacteria detection after long and short culturing, Funded by contract No 687681, LOVEFOOD2Market Horizon Project.

Major Collaborations:

- Department of Biology, FORTH Crete with the group of Prof. Electra Gizeli, on bacteria isolation on plasma functionalized biochips.

- Institute Pasteur, Paris France with the group of Dr. Bruno Dupuy on bacteria capture and detection after short and long culturing.

- Biomedical Research Foundation, Academy of Athens with the group of Dr. Antonia Vlahou on phosphopeptide enrichment and isolation using MALDI-MS.

- Immunosensors & Immunodiagnosics lab with the group of Prof. S. Kakabakos and P. Petrou (Institute of Nuclear & Radiological Sciences & Technology, Energy & Safety, NCSR Demokritos) on protein, DNA and antibody microarray fabrication and evaluation.

- Particle Technology Laboratory, with the group of Prof. S. Pratsinis (Institute of Process Engineering, Department of Mechanical and Process Engineering, ETH Zurich) on phosphopeptide enrichment using nanoparticulate TiO₂ films after flame spray pyrolysis.

Profile:

Research Highlights-Track record:

Starting with chemistry background I became an **expert** on micro- nano-fabrication processes for novel integrated micro-analytical devices, known as Micro Total Analysis Systems (m-TAS) or Lab on a Chip (LoC) for the analysis of biomolecules and cells. Both my MSc and PhD thesis were focused on the treatment of polymeric materials using lithography and plasma etching for the fabrication of LoC for biological applications. I produced two types of devices: a polymeric protein microarray and a polymeric TiO₂ affinity chromatography column for phosphopeptide enrichment. My thesis was supervised by Dr Evangelos Gogolides and co-supervised by Dr Angeliki Tserepi, at NCSR Demokritos.

My research and professional targets are:

(a) the mechanisms of Oxygen plasma nanotexturing of organic and Si-containing polymeric surfaces and the modification of their wetting properties in the broad range from stable super-hydrophilic to super-hydrophobic surfaces. Among the many related publications and patents the paper published in Langmuir (see reference 8), **rated 1st on Dispersion Chemistry, google scholar**, was one of the first papers in the literature presenting the mechanism of plasma nanotexturing and received up to now 185 citations.

(b) The use of a planar technology for polymeric lab-on-chip fabrication and surface modification. Among again the many publications and patents, the paper published in Lab Chip (see reference 3), **rated 2nd in subcategory analytical chemistry, google scholar**, was amongst the top ten accessed articles from the online version of Lab on a Chip Journal during the month of January 2013.

(c) The creation of intense protein, and protein-based DNA microarrays on plasma nanotextured polymeric substrates and microfluidics with 100x improved sensitivity compared to standard technologies. These substrates can facilitate the detection of low abundance substances and improve the analytical performance of protein and DNA microarrays. Essentially the technology and the devices developed in (a), (b) above were applied for many biological applications.

This work was done in collaboration with the Institute of Nuclear & Radiological Sciences & Technology, Energy & Safety, NCSR Demokritos in collaboration with Dr Sotirios Kakabakos and Dr Giota Petrous, and has resulted in many high impact factors publications.

Post doctoral research profile and achievements

Following my PhD I was recruited to work in a very prestigious Institute award, the Center of Excellence MinaSys project (<http://imel.demokritos.gr/Regpot/Project.html>), where I continued developing novel planar technologies for polymeric biochip fabrication and functionalization, working with Prof. Dimitrios Tsoukalas and Dr Evangelos Gogolides. Among my achievements was the demonstration of on-off control of biomolecule and cell attachment in hydrophilic versus superhydrophobic surfaces, allowing biomolecule and cell self-patterning, the preparation of polymeric affinity chromatography microcolumns with TiO₂ for phosphopeptide separation and reversed phase polymeric microcolumns. Following the high impact work at my first post-doctoral position, I then extended my work on bacteria capture on plasma nanotextured microfluidics and LoC for food safety analysis. This ongoing work is done in the framework for projects LOVEFOOD and LOVEFOOD2MARKET, and has resulted in high impact publications and patents.

Spin-offs, and academic metrics

The success, impact and promising applications of this work have led to the 2nd prize in the Applied Research and Innovation Contest for Excellence "Kainotomeis" with "Smart nanostructured surfaces and bioanalytic labs-on-chip" September 2013. Following the award I became one of the Co-Founders of the spin-off company called NANOPLASMAS Private Company that was founded in 2016. I am presently member of the plasma group in the Institute of Nanoscience and Nanotechnology, and an affiliated member of the Immunosensors & Immunodiagnosics Laboratory of Dr Kakabakos and Petrou as well as the Laboratory of Dr Mastellos.

My future plans are to apply my research experience, working knowledge and expertise in the enhancement of the design and application of novel portable lab on chip devices for separation of proteins and cells from biofluids and food matrices.

- Number of journal Publications: 40
- Number of book chapters: 3
- Number of Conference presentations (National, European and International): 80
- Patents: 3
- Number of Citations: 1649 citations since 2012 (google scholar). h-index of 21 (google scholar)
- Personal ranking 24th in google subject ranking "Lab on Chip" and 60th on "Bacteria".

Google profile:

<https://scholar.google.com/citations?user=M8LtzIIAAAJ&hl=en&cstart=20&pageize=20>

Scopus profile:

https://www.scopus.com/cto2/main.uri?ctoId=CTODS_780709062&authors=10045623300&origin=AuthorNamesList

Relevant Publications:

Bacteria and other biomolecules on functionalized surfaces and microfluidics

- 1) Tsougeni, K., Papadakis, G., Gianneli, M., Gizeli, E., Gogolides, E. **Plasma nanotextured polymeric lab-on-a-chip for highly efficient bacteria capture and lysis** (2016) *Lab on a Chip - Miniaturisation for Chemistry and Biology*, 16 (1), pp. 120-131
- 2) K. Tsougeni, A.S. Kastania, G. Kaprou, A. Tserepi, E. Gogolides, **Microfluidic sample preparation components for DNA-based food pathogen detection**, 20th International Conference on Miniaturized Systems for Chemistry and Life Sciences, MicroTAS 2016 (2016), pp. 681-2.
- 3) Tsougeni, K., Papageorgiou, D., Tserepi, A., Gogolides, E. **"Smart" polymeric microfluidics fabricated by plasma processing: Controlled wetting, capillary filling and hydrophobic valving** (2010) *Lab on a Chip - Miniaturisation for Chemistry and Biology* 10 (4), pp. 462-469.
- 4) K. Tsougeni, P. Zerefos, A. Tserepi, A. Vlahou, S. D. Garbis, and E. Gogolides **Polymeric Micro-fabricated TiO₂-ZrO₂ Affinity Chromatography Microchip for Phosphopeptide Enrichment and Separation** (2011) *Lab on a Chip - Miniaturisation for Chemistry and Biology*, 11 (18), pp. 3113-3120
- 5) Tsougeni, K., Petrou, P.S., Papageorgiou, D.P., Kakabakos, S.E., Tserepi, A., Gogolides, E. **Controlled protein adsorption on microfluidic channels with engineered roughness and wettability** (2012) *Sensors and Actuators, B: Chemical*, 161 (1), pp. 216-222.
- 6) K. Tsougeni, A. Bourkoula, P. Petrou, A. Tserepi, S.E. Kakabakos, and E. Gogolides **Photolithography and Plasma Processing of Polymeric Lab on Chip for Wetting and Fouling Control and Cell Patterning** (2014) *Microelectronic Engineering*, 124, pp. 47-52.
- 7) K. Tsougeni, A. Tserepi, E. Gogolides, **Polymeric Microfluidics: Fabricated and Modified Using Plasmas**, *Encyclopedia of Plasma Technology*, DOI: 10.1081/E-EPLT-120053912, Copyright © 2017 by Taylor & Francis.

Smart nanotextured surfaces

- 8) Tsougeni, K., Vourdas, N., Tserepi, A., Gogolides, E., Cardinaud, C. **Mechanisms of oxygen plasma nanotexturing of organic polymer surfaces: From stable super hydrophilic to super hydrophobic surfaces** (2009) *Langmuir* 25 (19), pp. 11748-11759.

Biomolecule binding on plasma nanotextured surfaces

- 9) K. Tsougeni, P.S. Petrou, K. Awsiuk, M.M. Marzec, N. Ioannidis, V. Petrouleas, A. Tserepi, S.E. Kakabakos, E. Gogolides **Direct Covalent Biomolecule Immobilization on Plasma-Nanotextured Chemically Stable Substrates** (2015) *ACS Applied Materials and Interfaces*, 7 (27), pp. 14670-14681.
- 10) Tsougeni, K., Petrou, P.S., Tserepi, A., Kakabakos, S.E., Gogolides, E. **Nano-texturing of poly(methyl methacrylate) polymer using plasma processes and applications in wetting control and protein adsorption** (2009) *Microelectronic Engineering* 86 (4-6), pp. 1424-1427.
- 11) Tsougeni, K., Tserepi, A., Constantoudis, V., Gogolides, E., Petrou, P.S., Kakabakos, S.E. **Plasma nanotextured PMMA surfaces for protein arrays: Increased protein binding and enhanced detection sensitivity** (2010) *Langmuir* 26 (17), pp. 13883-13891.
- 12) Tsougeni, K., Koukouvinos, G., Petrou, P.S., Tserepi, A., Kakabakos, S.E., Gogolides, E. **High-capacity and high-intensity DNA microarray spots using oxygen-plasma nanotextured polystyrene slides** (2012) *Analytical and Bioanalytical Chemistry*, 403 (9), pp. 2757-2764.
- 13) Tsougeni, K., Ellinas K., Koukouvinos, G., Petrou, P.S., Tserepi, A., Kakabakos, S.E., Gogolides, E. **3D Plasma Nanotextured slides performance for biomolecule microarrays: Comparison with commercially available coated glass slides** (2017) *Colloids and Surfaces B: Biointerfaces*, under review.

Patents

- 1) Patent from Hellenic Industrial Property Organization; Inventors; K. Tsougeni, P. Petrou, A. Tserepi, S. Kakabakos, E. Gogolides,
Title; "Method to fabricate chemically-stable plasma-etched substrates for direct covalent biomolecule immobilization",
Application No: 20140100319, 03.06.2014

List of relevant previous projects or activities, connected to the subject of this proposal:

- Cofounder and product development manager in Nanoplasmas Private Company.
- PhD thesis focused on Lab on Chip devices for bioanalytical applications.
- MiNaSys-Coe, Micro and Nano Systems - Center of Excellence FP7-REGPOT-2009-245940
Role: Responsible for Lab on Chip Activities
- LOVE FOOD programme Contract No 317742,
Role: Responsible for successful implementation of 2 Work Packages (see previous positions)
- LOVEFOOD2Market Horizon Project No 687681.

Role: Responsible for successful implementation of 2 Work Packages (see current position)

- ICT/NMP2 European project Nanoplasma NMP2 - CT - 2006 - 016424