# MIGRATE

**MIniaturized Gas flow foR Applications with enhanced Thermal Effects**

migrate microfluidics

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No. 643095

MIGRATE (Research and training network on **MI**niaturized **G**as flow fo**R A**pplications with enhanced **T**hermal **E**ffects) is planned as a multi-partner Innovative Training Network (ETN – European Training Network), assessing research and applications for thermal aspects of gas microflows. The network consists of 10 beneficiaries and 7 associate partners, spread all over Europe. This unique combination of university research, SME and world leading industrial stakeholders will contribute in a synergetic way to the increase of knowledge about micro scale gas flow heat transfer problems as well as to industrial applications of highly efficient miniaturized devices. Within MIGRATE, a number of Early Stage Researcher (ESR) projects will cover different aspects of enhanced heat transfer and thermal effects in gases, spanning from modelling of heat transfer processes and devices, development and characterization of sensors and measurement systems for heat transfer in gas flows as well as thermally driven micro gas separators to micro-scale devices for enhanced and efficient heat recovery in automotive, aeronautics and energy generation.

The ESRs recruited for the network will undergo training in at least three different locations. Additionally, short stays can be arranged at beneficiaries and associate sites. Moreover, annual network wide workshops and summer schools will ensure that each researcher receives exposure to, and benefits from, the full expertise of the Network.

More information can be obtained from www.migrate2015.eu.

Within the MIGRATE network a

## E S R Position

is offered at Institute of Mechanics, Bulgarian Academy of Sciences (IMechBAS) with the topic

# Thermal gas mixing in micro scale

Ref. N°: MIGRATE-ESR 12

The position includes secondments at

University of Thessaly, Volos, Greece

and

Mitis SA, Liege, Belgium

Short stays at different other beneficiaries or associated may be possible by negotiation.

Main goal: Development of efficient DSMC and DVM numerical algorithms and comparison to standard computational modeling to predict and improve the process of gas mixing in 2D and 3D micro mixers.

Duration: 3 years

Expected starting date: 1/04/2016

Application deadline: 10/01/2016

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No. 643095

**Detailed description of the project:**

Gas mixing is a problem of theoretical and industrial interest for development and optimal design of gaseous MEMS/NEMS (Micro/Nano-Electro-Mechanical Systems) devices. The study of thermal effects on the mixing characteristics is essential for the design of microdevices. The computational analysis of gaseous flows in MEMS devices operating under different thermal conditions in non-equilibrium flow regimes cannot be based on classical continuum models of fluid motion because the continuum assumption for a flow in local near-equilibrium state is no longer valid. An appealing aspect of non-equilibrium gas flows is that they can be analyzed in detail using the direct simulation Monte Carlo (DSMC) and kinetic model numerical methods.

The main aim of this project is to offer a complete study of the gas mixing phenomena in slip and transitional (non-equilibrium) flow regimes under different flow (thermal, pressure, molar etc.) conditions. The basic methodology for achieving this goal is built on the development of effective kinetic and DSMC models of gas mixing and their application to analyze gas mixing phenomena in 2D and 3D microchannel configurations and chambers. This is expected to help improving and optimizing the existing experimental setups and suggest ideas for new gaseous MEMS elements.

**Expected time schedule**

| ESR n°12 | Year 1 | | Year 2 | | Year 3 |
|---|---|---|---|---|---|
| *Stay* | 1st stay | 2nd stay | 3rd stay | 4th stay | |
| Location | **IMECHBAS** | **UTH** | **MITIS** | **IMECHBAS** | |

*1st stay:* introduction and modification of existing 2D and 3D Direct Simulation Monte Carlo (DSMC) code.

*2nd stay*: introduction and modification of existing 2D Discrete Velocity Method (DVM) code.

*3rd stay:* training on standard computational techniques used for industrial heat transfer exchangers. Comparison of results obtained by DSMC and continuum Navier-Stokes models.

*4th stay:* application of novel DSMC approaches to predict and improve the process of gas mixing in microchannel and 3D configurations and heat exchangers.

**Requirements**

This is a challenging and highly rewarding course of study and therefore the successful candidate will need to have the following qualifications:

- a masters-level degree in Applied Mathematics, Physics, Computational Science, or Engineering with high standard results;
- a good background in fluid mechanics and programming in Fortran and/or C++;

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No. 643095

- excellent communication skills and written/verbal knowledge of the English language;
- high autonomy and adaptability skills;
- if the candidate has some experience in Monte Carlo simulations, rarefied gas dynamics and microfluidics adapted to fluid flows, this would be a benefit.

**Financial information / Salary**

Monthly gross salary: 2,223 k€

Monthly mobility allowance: 600 € (researcher without family obligation) – 1 100 € (researcher with family obligation)

**Contacts:**

For further information please contact: Prof. Stefan Stefanov: stefanov@imbm.bas.bg

**Application procedure:**

Applications for this position, including a CV with the contact details of three referees, a covering letter, attestation of the diploma / master degree and last transcript of records, should be sent, using the reference number in the subject line and preferably via e-mail, to:

Prof. Stefan Stefanov: stefanov@imbm.bas.bg
Department of Mathematical Modelling and Numerical Simulations, Institute of Mechanics, BAS,
Acad. G. Bonchev Str., Block 4, Sofia 1113, Bulgaria
http://www.imbm.bas.bg/index.php?page=stefan-kanchev-stefanov

**Deadline: 10/01/2016**

Eligibility of your application can be checked here: www.migrate2015.eu/