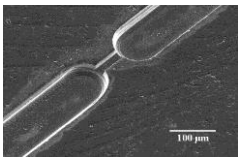


MIGRATE

MIniaturized Gas flow foR Applications with enhanced Thermal Effects

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 an

E S R Position (f / m)

is offered at Karlsruhe Institute of Technology (KIT), Karlsruhe (Germany) and Dipartimento di Ingegneria Industriale (DIN) of Alma Mater Studiorum – Università di Bologna (Italy) with the topic:

ESR02

Heat Flux, Temperature and Pressure Micro sensors

Ref. N°: MIGRATE-ESR 2

The position includes secondments at

ASML, Veldhoven (The Netherlands) (4 months)

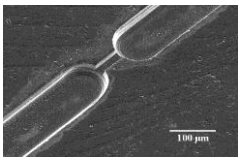
Short stays at different other beneficiaries or associated may be possible by negotiation.

Main goal: Development of innovative micro-sensors for weakly intrusive local measurements in microdevices. Combined experimental tests and numerical simulations.

Duration: 3 years

Expected starting date: 01/10/2016

Application deadline: **30/6/2016**



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Support for housing, in terms of language courses etc. is provided by all participating organisations.

Application of women is highly appreciated!

Detailed description of the project:

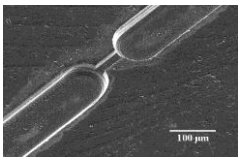
In Microfluidics,it is well known that some of the differences between the published experimental data on the dynamic and thermal behavior of microflows and the values predicted by using the classical theory were originated from the experimental methods used for the investigation of microflows and in particular for the determination of the local values of the main physical parameters (pressure, temperature, velocity) . Many different kind of miniaturized pressure sensors, heat flux meters and temperature sensors have been proposed and tested but until now a series of open questions appear to be unsolved in particular in presence of gas micro-flows.

The main objective of this project is to design a new generation of pressure, heat flux and temperature micro-sensors with specific features optimized for their use in presence of gas micro-flows.

During the project the ESR will test and compare a series of available techniques; for the determination of the pressure, the measurements obtained with conventional external pressure gauges will be compared with those obtained by using integrated pressure sensors micro-fabricated directly on the channel walls. For the determination of the local heat flux at the wall the measure obtained by using conventional heat flux meters placed on the external surface of the channel will be compared with the measurements obtained by means of integrated thermopiles placed directly on the micro-channel walls. For the determination of the temperature, wall micro-thermistors and thermo-chromic liquid crystals dispersed in the gas flow will be tested.

This project is a collaboration between 4 partners:

- The Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany, specialized in microstructure technology applied to micro process engineering (http://www.imvt.kit.edu/english/index.php). The microfabrication of the sensors will be made at KIT
- The Microfluidics Laboratory of the Department of Industrial Engineering (DIN) of University of Bologna (UNIBO), Bologna, Italy (http://www.industrial-engineering.unibo.it/en), specialized in experimental analysis of gas and liquid microflows.
- ASML (http:// www.asml.com), specialized on microelectronics and silicon technology.
- Politecnico di Milano (POLIMI), Italy (http://www.aero.polimi.it/), specialized in mathematical and numerical modelling of fluid flows far from equilibrium and in kinetic theory of fluids.



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Expected time schedule

The Early Stage Researcher will spend the majority of his/her time at KIT and at UNIBO, with a 4-month secondment at ASML and a short visit at POLIMI. The ESR will be enrolled as a PhD student at KIT; the PhD thesis will be co-tutored (KIT-UNIBO). The label of "Doctor Europaeus" will be asked for the ESR. A double degree obtained from KIT and UNIBO will be tried to set-up.

ESR n°2	Year 1	Year 2	Year 3		
	1st stay	2nd stay	3rd stay	4th stay	5th stay
Location	**KIT**	**UNIBO**	**ASML**	**UNIBO**	**KIT**

1st stay - KIT (12 months): Literature review on experimental techniques for local pressure heat flux and temperature measurements in microchannels. Training on microfabrication techniques (metals, polymeric materials). Design and microfabrication of micro-sensors. In this stage, the PhD student could collaborate with another Migrate Early Stage Researcher (ESR 1 – Micro Pirani pressure sensors) supervised by KIT.

2nd stay - UNIBO (12 months): Sensor calibration training. Design of the data acquisition system. Design of the experiments. Numerical modelling of the sensors. In this stage, the PhD student could collaborate with another Migrate Early Stage Researcher (ESR 13 – Gas Micro heat exchangers) supervised by UNIBO.

3rd stay - ASML (4 months): Training on the silicon manufacturing.

4th stay - UNIBO (4 months): First validation of the pressure, heat flux and temperature sensors.

5th stay - KIT (4 months): Complementary experiments on the prototypes. Writing of the PhD thesis.

Short visit(s): In addition, during periods spent at UNIBO, the Early Stage Researcher will have the possibility, during short visits of a few weeks, to be trained on numerical methods by POLIMI.

Requirements

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

- Master-level (5 years) degree in Physics, Mechanical Engineering, Process Engineering or similar, with high standard results;
- very good background in fluid mechanics and heat transfer;
- excellent communication skills and written/verbal knowledge of the English language;
- high autonomy and adaptability skills;

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- very good background in the field of experimental heat transfer and fluid-mechanics is appreciated as well as the knowledge of LabVIEW.
- some knowledge in microstructure technology will be an advantage, but not a pre-condition.
- skills in CFD will be helpful;

Financial information / Salary

Monthly gross salary including employer's contribution to social security: 3 073 € during the stays in Germany and Italy.

Annual mobility allowance: 7,200 € (researcher without family obligations) – 13,200 € (researcher with family obligations).

Contacts:

For further information please contact: Dr. Prof. Ing. Gian Luca Morini, gianluca.morini3@unibo.it.

Application procedure:

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

PD Dr.-Ing. habil. Juergen J. Brandner: juergen.brandner@kit.edu
and
Prof. Ing. Gian Luca Morini: gianluca.morini3@unibo.it.

Deadline: 30/6/2016

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