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 Bell Labs, Ireland, with the topic

Thermal Conditioning by Nozzle Gas Microflows

Ref. N°: MIGRATE-ESR 14

The position includes secondments at

Technische Universiteit Eindhoven (TUE), Netherlands (6 Months)
Aix-Marseille University (AMU), France (4 Months)

and short stays at ASML Netherlands B.V., Netherlands for additional training in an industrial capacity.

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

Main goal: Investigate solid-gas heat transport phenomena at the microscale. Perform experiments and simulation of thermal properties and surface effects of diverse materials and their effect on transport in rarefied nozzle gas flows.

Duration: 3 years

Expected starting date: 01 – September - 2016

Application deadline: **01 – June – 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:

The past decade has seen a considerable growth in portable devices with mobile connectivity. This growth has been enabled by the development of high capacity telecommunication networks globally. Individuals require high data transfer capabilities to remotely stream large information sets (i.e. HD video) and this is leading to greater demands for next generation networks (i.e. 5G). To ensure this growth continues, hardware devices must be smaller, more energy-efficient and provide greater functionality. This requirement poses a thermal management challenge, increasing heat transfer density significantly. Novel materials and cooling methods, which are engineered at the micro- and nanoscale, are necessary to address this.

The main objective of this research PhD will be to investigate, both experimentally and numerically, the conjugate heat transfer behaviour from various solids (Si, polymer composites) to nozzle gas microflows for different rarefaction levels. The project is a collaboration between 3 institutions. Experimental research will be conducted at Bell Labs and include development of novel materials and measurement of transport properties. At Aix-Marseille University, heat transfer to the gas and surface accommodation coefficients will also be experimentally measured for the proposed geometry. Numerical analyses will be conducted at Technische Universiteit Eindhoven using Molecular Dynamics to provide a comprehensive understanding of the transport phenomena through simulation of the conjugate heat transfer configuration.

Expected time schedule

ESR n°14	Year 1		Year 2	Year 3	
	1st stay	2nd stay	3rd stay	4th stay	5th stay
Location	**BELL**	**TUE**	**BELL**	**AMU**	**BELL**

1st stay: BELL (9 months) – Literature review on gas heat exchange in microdevices and nanoscale energy transport. Design an experimental facility to test thermal transport properties of solid materials (Si, polymer composites). Design microscale prototypes for solid-gas testing campaign.

2nd stay: TUE (6 months) – Implementation of Molecular Dynamics (MD) using the ReaxFF approach to model the gas-wall interactions of the prototype nozzle geometries and determine overall kinetic and thermal accommodation coefficients. Extension of the model to include heat transport in the solid and the effects of surface geometries and roughness.

3rd stay: BELL (9 months) – Perform intensive testing schedule on prototypes to understand local transport phenomena for various solid-gas arrangements and gas rarefaction levels. Simulate the system using DSMC/CFD with boundary conditions taken from previous MD findings.

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4th stay: AMU (4 months) – Experimentally measure the accommodation coefficients under different pressures and gas flows.

5th stay: BELL (8 months) – Compare computational with experimental findings. Improve the fundamental understanding of gas dynamics, solid-gas heat transfer and practical implementation of the micro heat exchange devices. Writing of the PhD thesis.

In addition, a Short Visit (a few weeks) to ASML Netherlands B.V., Netherlands (for application of techniques within another industrial sector).

Requirements

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

Diploma/Masters level degree in Materials Science, Physics, Engineering (Mechanical, Aeronautical, Chemical or similar), Applied Mathematics or related. Experience in heat transfer/fluid mechanics/materials desirable. Previous experience in numerical methods and/or numerical analysis of experimental datasets would be beneficial. Excellent English and presentation skills.

Financial information / Salary

Monthly gross salary: 3529 €

Monthly mobility allowance: 600 € (researcher without family obligation) – 1100 € (researcher with family obligation)

Contacts:

For further information please contact Dr. Jason Stafford: jason.stafford@alcatel-lucent.com and Dr. Arjan Frijns: a.j.h.frijns@tue.nl

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:

Dr. Jason Stafford: jason.stafford@alcatel-lucent.com
Dr. Arjan Frijns: a.j.h.frijns@tue.nl

Deadline: 15 – January – 2016

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