



MIGRATE Deliverable D 4.6. Progress Report No. 1 for the time from November 1, 2015 – July 31, 2016

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by

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MIGRATE (Miniaturized Gas flow for Applications with Enhanced Thermal Effects) is a Marie Skłodowska-Curie Innovative Training Network (ITN) funded by the European Union under the Horizon 2020 Programme (call H2020-MSCA-ITN-2014).

The project's background is linked to the fact, that depletion of natural resources combined with the extending footprint of mankind has led to a shift in importance of research and development topics. At present, emphasis is focused on resource efficiency as a primary objective. The European Roadmap of Process Intensification^[1] identifies several measures: miniaturization, improved heat transfer, and waste heat recovery. It is a well-known fact that minimization of heat and mass transfer resistances lead to tremendous increase in the related transport capacities. Thus, miniaturized devices will play a key role in future industrial applications and transport systems as well as in the re-design of existing processes that directly impact on the daily life of citizens, ranging from industrial technologies to personal equipment.

However, there are significant gaps in the fundamental knowledge-base for both mass and heat transfer processes in the micro scale. Current research is primarily focused on phase transition or multi-phase flows, with less attention paid to single-phase gas flows. Measurement systems with sufficiently high temporal and spatial resolution to clarify phenomena in micro scale are not available in many cases, and modelling of such processes is exceptionally challenging. Because of this, pre-calculation and design of miniaturized devices is often based on trial-and-error. This is especially the case for heat transfer using gases. While natural convection systems are described clearly and well-understood, forced convection, enhanced micro-scale heat transfer or heat transfer at reduced pressure levels is not well understood. Optimization of gas-based miniaturized devices for thermal applications with regard to pressure losses, materials, microstructure design, modelling and simulation, let alone measurement and control of processes using such devices are not yet present in technological solution portfolios, although there are many applications of such devices.

MIGRATE is intended to address some of the current challenges to innovation that face European industry with regard to heat and mass transfer in gas-based micro-scale processes. A Marie Skłodowska-Curie ETN innovation training network will be established spanning numerical, experimental, theoretical and applied research experts across academia, large scale industry and high-tech SMEs. Within MIGRATE, 15 Early-Stage Researchers (ESRs) will be trained through projects that will cover different aspects of enhanced heat transfer and thermal effects in gases. The presented publication will provide an overview to the activities within the MIGRATE project, depict planned topics and actions as well as present an outlook to future expectations and perspectives.



The MIGRATE ITN gathers this understanding by bringing together an intersectoral and multidisciplinary collaboration between eleven academic and 6 industrial participants from 10 European countries. The consortium combines and shares expertise to offer training at an advanced level in various sub-topics.

^[1] <http://efce.info/Working+Parties/Process+Intensification/Discussion+Forum/EUROPIN.html>

1. General Progress of MIGRATE

MIGRATE started on November 1st, 2016. It was planned to recruit 15 Early Stage Researchers (ESR) in two waves, namely 10 of them before or in April 2016, and 5 before or in September 2016. With having those ESRs recruited, the work in the planned topics in terms of research and development of sensors, mathematical models, simulations software and miniaturized devices is intended to be performed.

It turned out that it was not so easy to recruit suitable candidates for the ESR positions. Major delays have been arisen, either from difficulties to find candidates which show for the topic suitable knowledge, or from visa problems for the hired candidates. This led to major delays on nearly all ESR positions and topics. Meanwhile, almost all ESR for the first wave have been recruited and started their work, while for the second wave the last recruitments are about to be finished. However, the candidates arrived thus far, provide significant advances in their topic, as can be shown at a later stage of the project by their monthly and quarterly reports.

In almost all cases, the ESR students started their work at the beneficiaries' site with a comprehensive literature review on their specific topic. A good networking level was reached with the 1st MIGRATE Summer School (June 27 & 28, 2016) and Workshop (June 30 & July 1, 2016), that were held in Strasbourg, France. Despite the limited preparation time and the fact that MIGRATE is not yet so well-known within the international community, 39 participants have attended each of these events, 5 thereof coming from outside the network. It can be also noted that only 5 ESRs out of 15 had been already recruited and arrived at their supervision site at that time. 16 lectures have been given during the Summer School: 6 lectures in plenary sessions, among which 3 invited lectures given by scientists from outside the network, and 10 lectures in two parallel sessions devoted to "Theory & Design" and to "Experiments & Microfabrication". The overall satisfaction of the participants, assessed by means of feedback forms, was very good with an average mark slightly higher than 4 out of 5 degrees. Some of the lectures offered during this first MIGRATE Summer School will be kept for the second edition. Additionally, lectures on complimentary skills (intercultural relationship, discussion and argue management) have been provided, which have been acknowledged very well.

27 presentations have been given during the Workshop, among which 3 keynote lectures given by scientists from outside the network. The 5 ESRs already recruited (as well as one ESR of which the contract starts at September 1) in the network have presented their work on a poster coupled to a short oral presentation. Thanks to the limited number of presentations, this first edition of workshop has been organized in a unique session, allowing the participants to attend



all the presentations. The interactions between the speakers and the audience could thus take place in an optimal way. A list of the lectures and talks of these first events is given in the attachment.

Next events will be organized in Sofia, Bulgaria in June/July 2017. All the 15 ESRs recruited within MIGRATE will participate in both these events. In addition, more publicity will be given to these events, the preparation of which has already started. Thus, we expect the number of external and internal participants to increase within the upcoming events.

In terms of the management activities on the general project level, there have been a lot of actions taken. On December 8, 2015, the Kick-Off Meeting took place in Eindhoven, where also the creation of the Supervisory Board and Executive Board, as well as the appointment of an External Expert and the Executive Board.

From this date onwards, the management was performed continuously and very softly, through different EB meetings (mainly online) up to the General Assembly on June 30, 2016, and the 1st Supervisory Board Meeting on July 2, 2016, both in Strasbourg. For all those events, the slides can be presented on request, the files being literally too big to apply as amendments here.

Due to the recruitment delays described already above, the project currently has a slight delay for the start of the ESR projects of 1 month (ESR15) and up to 7 months (ESR4, ESR11 and ESR13). Some of this is also due to visa problems with the people already hired (ESR13). However, it is expected that all young researchers' projects can be finished within the run-time of MIGRATE.

2. Recruitment Strategy

The recruitment process was raised by the NC together with the principal investigators (PI) of each beneficiary. A common description of MIGRATE was provided, which then was completed by the topical description for each ESR position. An analysis on possible publication sites and formats has been performed in advance. All the descriptions have been put online onto the MIGRATE homepage, but also to the beneficiaries websites, to EURAXESS, to LinkedIn, ResearchGate and some other online contents as well as by personal approach to colleagues and existing networks of each partner. Special care was taken to the gender balance, NC and AC were supported by the Gender Board of KIT to find specific opportunities to publish the ESR positions in networks primarily for women in science and technology. However, the impact of this measure was marginal as only 4 female candidates have applied for the positions. One of these has been hired (ESR 1), two more are still under consideration to be (for ESR 2).

The selections of the ESR candidates have been performed by the beneficiaries. The coordinators should have obtained extended information on the number of applicants, names, nationality, gender and eligibility, to perform statistics on all ESR positions. Unfortunately, some of the beneficiaries have not yet provided all information needed to be already integrated to this report. Due to the fact that the recruitment of the second wave of ESR is still ongoing (two positions are not filled yet), a complete statistical overview cannot be given yet.



Some points have to be highlighted with regard to the ESR recruiting:

There was a considerably small number of female applicants – only 4 women applied yet for all the ESR positions! This is astonishing with regard to the measures taken as described above and comparing to former ITN activities. This might be due to the topic, but it seems to us that there was not much interest caused within the specific gender networks also.

It is also to note that a majority of applicants were coming from the three countries India, Pakistan and Iran. Unfortunately, Iran and Pakistan are the countries for which most problems with regard to Visa are to expect, whereas the decision on some applicants was hard to take. It was very surprising that the number of applicants from China was very low, showing only a handful of candidates for all 15 positions. This might be due to a change in the Chinese politics against EU and ITN projects, but a clear reason could not be found.

In terms of the applicant's numbers, it turned out as follows:

ESR 01:	14 applicants
ESR 02:	27 applicants
ESR 03:	not available yet
ESR 04:	not available yet
ESR 05:	11 applicants
ESR 06:	18 applicants
ESR 07:	not available yet
ESR 08:	not available yet
ESR 09:	22 applicants
ESR 10:	9 applicants
ESR 11:	22 applicants
ESR 12:	23 applicants
ESR 13:	18 applicants
ESR 14:	not available yet
ESR 15:	11 applicants

In general, the number of applicants is sufficiently high to make a good choice. However, lots of the candidates have applied for several positions, thus, the true number is smaller than proposed from here. A complete statistical overview will be provided as soon as possible.



3. Career Development Plan for each recruited researcher

A template for the CDP was prepared and is available for all beneficiaries and ESR on the website (<http://www.migrate2015.eu/106.php>). For most ESR already hired, a CDP draft has been proposed, which is now under negotiation between the supervisors, the mentors, the ESR, the Group Coordinators (GC) and the Training and Events Coordinator (TEC). It is expected that all CDP are finally negotiated and at hand until the end of the second recruiting wave.

4. Management

Management was performed in general by the team of Network Coordinator and Administrative Coordinator at KIT, Karlsruhe, Germany, stated with a Discussion of setting-up initial steps on November 3rd 2015 - followed by weekly project Jours Fixes between NC and AC. Together with the legal department of KIT, the Consortium Agreement was proposed and arranged in advance to the GA. Furthermore, a Kick-Off Meeting (Dec 8, 2015), two EB meetings (Dec 17 2015, June 1, 2016), an SB meeting (July 2, 2016) and a General Assembly (June 30, 2016) have been prepared and performed.

These meetings were used for presentation and discussion of project overview, of administrative issues (finances, budget, reporting, dissemination), as well as of Amendments to the Consortium Agreement, and of details of the ESR recruitment. Also the repartitions of costs to create an budget for events, travel and administrative issues as well as organizational aspects of the first summer event were discussed there, such as registration process, conference fees payment, travel management and settlement of costs for invited speakers). Current points of discussion are the plans for the Mid Term Meeting in 2017.

Minutes of all these meetings are continually made-up and can be viewed on request. The first MIGRATE events (Summer School, June 27 & 28, 2016) and Work Shop (June 30 & July 1, 2016) have been prepared and organized together with the Trainings and Event Coordinator (TEC). The next event is planned already for summer 2017 to take place in Sofia, Bulgaria. Several templates have been provided, and support for eligibility check for ESR recruiting as well as statistical data, publication of the open positions etc. have been proposed and given.

Up to December 4, 2015, the main structure and major contents of the MIGRATE Website was published, and is, since then continuously under improvement. Besides dissemination of knowledge on the projects topics, it has been used for advertising the ESR positions, announcing dates and contents of meetings and events. Therefore, a continuous updating has been performed since the launch.

The management support of the recruiting is limited by some restrictions of several beneficiaries. In terms of the data to be provided for statistical reasons, the Irish beneficiaries are very much restricted, as well as the beneficiaries from France. This is limiting the availability of data.



Moreover, the current refugee situation all over Europe delays the time schedule for obtaining visa for certain ESR. More than once the NC was necessary to communicate directly to the related embassy to obtain a visa for an ESR candidate. Special problems arise here for candidates from Iran and Pakistan, because those are considered to be supporter states of IS and other terroristic organizations.

Risks in terms of IP management had already been identified and clarified within the CA. Other risks, for the time being, lay within the delay for the most ESR projects. However, if all ESR positions are filled until end of September, all projects can be finished within the runtime of MIGRATE.

5. Communication Activities

Numerous communication activities have been performed, starting with the publication of the MIGRATE website on December 4, 2015. Following this, a first Keynote Presentation on MIGRATE was given at the 2nd International Conference on Non-equilibrium Gas Flows, taking place Dec 9 & 10, 2015, in Eindhoven, NL (for further info, please see <https://www.tue.nl/en/university/departments/mechanical-engineering/research/research-groups/energy-technology/2nd-european-conference-on-non-equilibrium-gas-flows-december-9-11-2015/>). Aside of this, the first MIGRATE event gave room for first publications on the topics within the network. 20 presentations and 6 posters have been shown on this occasion, giving an overview to the ongoing activities as well as to the actual status and plans for the next few months.

In Addition, a LinkedIn profile was established to allow all scientists interested to share the networking experience of MIGRATE as well as to discuss on the topics.

6. Impact

At the current stage, the impact of MIGRATE ITN is localized mainly to the network itself and some additional institutions accompanying the ITN. It is too early in the project to see a major impact of the work to European scientific community or global knowledge. This is to expect following the first journal publications on the ESR topics as well as presentations on international conferences, most likely starting in late 2016 (Keynote of the NC and GCs at MNF 2016, Sep 11-14, Milano, Italy; see: <http://mnf2016.com/>; Keynote of the NC on AIChE National Meeting, Nov 13-18, 2016, San Francisco, USA; see: <http://www.aiche.org/conferences/aiche-annual-meeting/2016>). However, the MIGRATE community is very well prepared, and networking is running in an excellent way. Even the ESR, although not familiar to each other, created an internal network immediately.

It is to expect that the impact of MIGRATE will be reasonable from 2017 onwards.




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