NEGF15-INVITED LECTURE

MIGRATE – A NEW EUROPEAN INNOVATIVE TRAINING NETWORK FOR GAS FLOW HEAT TRANSFER IN MICROSCALE

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KEY WORDS

Gas Microflows - Microfluidics - Gas heat transfer - Miniaturized equipment

ABSTRACT

Depletion of natural resources combined with the extending footprint of mankind has led to a shift in importance of research and development topics. Emphasis is now 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 in- crease 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.

(1) http://efce.info/Working+Parties/Process+Intensification/Discussion+Forum/EUROPIN.html