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Editorial

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The 7th Conference of the International Marangoni Association (IMA7) was held at Vienna University of Technology, Austria during June 23–26, 2014. Scientists and engineers from twenty different countries (Fig. 1) discussed current trends and advances in the field of interfacial fluid dynamics. As for previous conferences IMA7 was organized under the auspices of the International Marangoni Association (`http://marangoniassociation.com`).

More than hundred papers were presented during oral and poster sessions. The subjects covered a multitude of current problems in interfacial fluid mechanics (for a classical review, see [1]). Typical topics have been Marangoni effects such as thermo- and solutocapillary flows, flow and interfacial instabilities, droplet dynamics, liquid films and liquid bridges as well as contact-angle and contact-line dynamics. These subjects were treated analytically, numerically and experimentally. The different topics and approaches led to inspiring discussions to the benefit of a better understanding of the underlying complex physical mechanisms. The present volume of EPJ-ST gathers selected and fully reviewed papers providing a representative cross section of the research fields covered by the IMA7 conference.

When a temperature or solute gradient exists perpendicular to a fluid–fluid interface the state of rest of a fluid can become unstable due to the dependence of the interfacial tension on temperature or solute concentration. The emerging fluid flow is called Marangoni convection [2,3]. Of interest are the influence of the geometry of the confining boundaries on the threshold temperature gradient (Marangoni number) and the flow patterns which develop. The situation is complicated by the dynamic deformability of the interface which plays a key role for long-wave flow instabilities. Owing to the complicated nature of the problem there is a considerable interest in a simplified modeling, e.g., by use of a Hele–Shaw-cell geometry. These problems are addressed by a first group of papers.

When the surface tension varies tangentially to the interface a thermocapillary flow arises immediately [4]. One of the most fundamental geometries to study this type of flow is the so-called liquid bridge kept in place between two parallel plates or by disks [5]. The mechanical stability of isothermal liquid bridges is studied with emphasis on contact angle hysteresis. For thermocapillary, i.e. non-isothermal, liquid bridges the basic flow is steady. Of interest here is the onset of time-dependent flow which is in general three-dimensional and the dependence of the critical Marangoni number on the geometrical constraints such as the length-to-radius ratio and the volume of the liquid bridge. A more recent topic is the fast accumulation of particles suspended in a liquid bridge [6]. The structure of the intriguing three-dimensional

Fig. 1. Participants of IMA7 in front of the main building of Vienna University of Technology.

rotating particle accumulation patterns (PAS) and their dynamic evolution are studied, as well as axisymmetric accumulation during which a region near the axis of the liquid bridge becomes depleted of particles. In certain configurations the thermocapillary flow can also become unstable to thermocapillary surface waves, a mode of instability in which the dynamic deformability of the interface is of crucial importance.

A tutorial review of these thermocapillary surfaces wave leads over to a series of contributions devoted to interfacial waves [7,8]. Flow regimes and waves forms are studied for a pure mechanical system in which the waves are generated by an oscillating cylinder submerged near an interface. A classical macroscopic problem is the falling film [9]. Upon harmonic modulation of the inlet flow solitary-type of waves can develop downstream. The dynamic evolution of the interface as well as the temperature distribution are investigated when regular three-dimensional structures are triggered by periodic spanwise perturbations. Related problems are the evolution and breakup of horizontal thin liquid-metal films subject to initial periodic perturbations of the substrate and, for very thin films, the effect of thermal fluctuations on droplet spreading and contact angle.

Heat and mass transfer in interfacial flows is of considerable importance. After a mini review of the interfacial mass transfer in the presence of Marangoni effects the evaporation of micro-droplets on a solid surface is investigated taking into account the thermocapillary effect and considering the transport of liquid-suspended particles. Another interesting interfacial system is represented by the condensation and collapse of vapor bubbles injected into their sub-cooled liquid phase. High-speed-camera observation reveals the collapse of bubbles always being initiated by growing small-wavelength interfacial perturbations before the bubble finally collapses abruptly, for sufficient under-cooling.

Further contributions are devoted to the influence of electric fields on the interface between two fluids in a microchannel and on the particle-deposition structures emerging from the evaporation of a colloidal solution. Finally, the paradoxical situation is considered and a modeling solution offered when the surface heat capacity is negative and the energy balance of an interface plays the role of a boundary condition for the bulk equations. Complicated interfacial structures are present in foams. A particular problem theoretically and numerically treated in the final contribution of this volume is the foam drainage in the presence of a porous support.

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