CPP 46: P11: Wetting, Micro and Nano Fluidics

Time: Wednesday 10:00–13:00 Location: Poster A

CPP 46.1 Wed 10:00 Poster A

Enhanced microfluid mixing due to the near-surface transport of superparamagnetic bead rows — •Dennis Holzinger and Arno Ehresmann — Department of Physics and Center for Interdisciplinary Nanostructure Science and Technology (CINSaT), University of Kassel, Heinrich-Plett-Str. 40, D-34132 Kassel

An accurate computational fluid dynamic simulation model is presented for the domain wall movement assisted transport (DOWMAT) of full superparamagnetic bead rows above a micromagnetic stripe-patterned exchange bias layer system for enhanced active mixing in a laminar flow microfluidic device using Comsol Multiphysics.[1,2] The simulation model takes into account the effect of device length scales, the diffusive properties of the diluted species and the applied movement scheme of the superparamagnetic bead rows. The results demonstrate that the maximum achievable mixing velocity strongly depends on the above stated parameters, so that the microfluidic device parameters can be specifically tailored e.g. for biosensing applications in lab-on-a-chip (LOC) devices prior to the experimental implementation.

[1] A. Ehresmann, D. Lengemann, T. Weis, A. Albrecht, J. Langfahl-Klabes, F. Goellner and D. Engel, Adv. Mater. 23, 5568 (2011)
[2] D. Holzinger, D. Lengemann, F. Goellner, D. Engel and A. Ehresmann, Appl. Phys. Lett. 100, 153504 (2012)

CPP 46.2 Wed 10:00 Poster A

Quantifying dynamic wetting of surfactant solutions — Franziska Henrich, Dorota Truszkowska, Hans-Jürgen Butt, and •Günter K. Auernhammer — MPI Polymer Research, Mainz, Germany

Although in recent years there have been efforts to gain better understanding on the dynamic wetting of surfactant solutions [1,2], the flow profile near the 3-phase contact line still is not entirely known. In the hydrodynamic model of the flow profile, the diffusion of surfactant to the surface plays an important role, since in this model surfactant molecules flows due to gradient of the surface tension to the new surface near the 3-phase contact line. In this contribution we present methods to determine the dynamic contact angle, the flow profile and the surfactant concentration. We discuss the characteristic changes due to different surfactants and surface structure.

[1]Fell, D. et al. Langmuir (2011): 27(6) 2112-2117
[2] Fell, D. et al. Colloid and Polymer Science (2013), 291(2) 361-366

CPP 46.3 Wed 10:00 Poster A

Relaxation of Surface Perturbations in Thin Liquid Films as a Probe of Liquid/Substrate Interactions — •Marco Rivetti[1], Christine Linne[1], Paul Fowler[1,2], Joshua D. McGraw[2], Thomas Salez[3], Michael Benzaquen[3], Elie Raphaël[3], Kari Dalnoki-Veress[2,3], and Oliver Bäumchen[1] — [1]Max Planck Institute for Dynamics and Self-Organization (MPIDS), 37077 Göttingen, Germany — [2]Department of Physics & Astronomy, McMaster University, Hamilton, Canada — [3]PCT Lab, UMR CNRS 7083 Gulliver, ESPCI ParisTech, PSL Research University, Paris, France

Perturbations of the free surface of a thin liquid film relax due to capillary forces. Flow is driven by local curvature gradients of the surface and resisted by the liquid's viscosity. For an initial non-equilibrium profile given by a step geometry, capillary leveling is shown to result in self-similar profiles. We find an excellent agreement between experimental profiles, as obtained from atomic force microscopy data, and numerical calculations. For liquid films supported by rigid substrates and in the presence of a no-slip boundary condition, this system provides a precise nano-rheological probe of the capillary velocity. For flows on small length scales, however, the interactions of liquid molecules with the substrate at the solid/liquid interface become important. We show that the capillary levelling is sensitive to the slip boundary condition at the solid/liquid interface. Thin film models comprising hydrodynamic slip enable a quantification of the slip length. Aside from friction, energy can also be dissipated through the elastic deformation of the substrate, which we will discuss in detail.

CPP 46.4 Wed 10:00 Poster A

Liquid-liquid dewetting — •Stefan Bommer[1], Nikolas Becker[1], Ralf Seemann[1], Sebastian Jachalski[2], Dirk Peschka[2] und Barbara Wagner[2] — [1]Universität des Saarlandes — [2]TU Berlin

The transient morphologies towards equilibrium of liquid droplets dewetting on another liquid as well as the dynamics of dewetting rims are considered experimentally and theoretically. As liquids short chained polystyrene and polymethylmethacrylate are used which are glassy at room temperature and which can be considered as Newtonian liquids well above their glass transition temperatures. The liquid/air interfaces are imaged in situ by scanning force microscopy whereas the liquid/liquid interface is imaged after solidifying the sample and removing the dewetting polystyrene. The transient shapes are modeled by lubrication approximation and Stokes model using the relevant experimental parameters like the ratio of film thicknesses, the viscosity rations, the ratio of the surface tensions of the liquid/air and the liquid/liquid interface, and the contact angles. A remarkably independence of the transient shapes on the start conditions was found theoretically for sufficiently 'mature' droplets which allow for a quantitative comparison with experimental droplet morphologies. Carrying on from this successful comparison, we also investigate the shape and dynamics of dewetting rim profiles.

CPP 46.5 Wed 10:00 Poster A

Super Liquid-Repellency: Mechanical Robustness vs. Repellency — •Maxime Paven, Frank Schellenberger, Michael Kappl, Doris Vollmer, and Hans-Jürgen Butt — Max Planck Institute for Polymer Research, Mainz, Germany

So-called super liquid-repellent - or superamphiphobic - layers cannot only repel water but also many low surface tension liquids like soap solutions, hexadecane or organic compounds. Superamphiphobic surfaces have various potential applications ranging from self-cleaning solar cells to anti-biofouling medical devices. Next to a simple fabrication method, the mechanical robustness and durability of these layers is mandatory. Recently, our group developed a facile surface preparation technique to fabricate superamphiphobic layers, based on a fractal-like network of hydrophobized nanometer sized silica spheres. Considering the surface morphology, a simplified theoretical approach predicts, that the mechanical robustness and liquid repellency cannot be increased at the same time. We studied the interplay between mechanical robustness and repellency experimentally. By tuning the reaction parameters, surfaces with varying mechanical and wetting properties were obtained. The elastic and plastic responses of these layers were investigated by atomic force microscopy (AFM). Therefore, a colloid was attached to a cantilever and force versus distance curves were recorded and analyzed. The wetting properties were assessed by measuring the receding and tilting angle of hexadecane on these surfaces. We observed that an improvement of the mechanical robustness was accompanied with a decrease of the liquid repellency.

CPP 46.6 Wed 10:00 Poster A

Quantification of spontaneous imbibition processes in nanoporous systems — •Christian Thome and Heiko Rieger — Universität des Saarlandes, Saarbrücken, Germany

The study of spontaneous imbibition processes in micro- and nanopores is important for various applications like oil recovery, water flow through soil or drug design. In porous media with elongated pores one can observe a dynamical broadening of the imbibition front which is caused by the temporal arrest of some menisci. This effect has also been shown by microfluidic studies in y-shaped junctions. Here the arrest time of the meniscus in the bigger channel is proportional to the feeding channel length. In contrast to microfluidic channels nanofluidic devices have a high surface-to-volume ratio. As an example we consider a system where a piece of nano-porous vycor glass is in contact with a water reservoir. Density fluctuations over intermolecular distances can be important in this system. For this reason we investigate the flow beavior of the imbition process of water in nano-porous vycor glass with molecular dynamics simulations using a simple Lennard Jones model fluid. The imbibition speed of the meniscus and the speed of the fluid layer in direct contact to the wall atoms is estimated as a function of the wall/fluid-particle-interaction-strength. Futhermore we consider a nano-pore-junction connecting 3 nano-pores of different radii. After filling the feeding channel, the liquid penetrates the smaller of the two outgoing channels and arrests in the bigger one. The arrest

time of the meniscus in the bigger tube is determined as a function of the feeding channel length for different junction geometries.

CPP 46.7 Wed 10:00 Poster A

What controls the wettability of bidisperse bead pack? — •Robabeh Moosavi[1], Julie Murison[1], Thomas Hiller[1], Martin Brinkmann[1,2], and Matthias Schröter[1] — [1]Max-Planck Institute for Dynamics and Self-Organization, Göttingen, Germany — [2]Universität des Saarlands, Saarbrücken, Germany

We report experiments on liquid two-phase flow in bidisperse bead packs. The bidisperese bead pack consists of small and large beads which are either oil wetting or water wetting. The aim of this work is to understand which property of the prepared sample determines its average wettability and how this is linked to the residual oil saturation. To characterize the different samples we measure the capillary pressure saturation curves (CPSC) where the sample is alternately invaded by water and oil. In addition to the CPSC experiments we also carried out x-ray tomography and numerical simulations of two-phase flow with wetting using multi-particle collision dynamics (MPCD). So far, the comparison of the different methods indicate that segregation of beads in the CPSC experiment may have an effect on the determination of the average wettability of the sample.

CPP 46.8 Wed 10:00 Poster A

Continuum approach to the statics and dynamics of two-phase systems — •Nikita Tretyakov[1], Jasna Zelko[1], Kostas Ch. Daoulas[1], and Burkhard Dünweg[1,2,3] — [1]Max Planck Institute for Polymer Research, Mainz, Germany — [2]Institute for Solid State Research, TU Darmstadt, Germany — [3]Dept. of Chemical Engineering, Monash University, Australia

The most appropriate theoretical description of, e.g., droplets near surfaces, and similar systems, is computational modeling based upon continuum thermodynamics (statics) and hydrodynamics (dynamics).

In the statical case, we present a field-theoretical description [1, 2] of water-vapor interface in the vicinity of a corrugated substrate at nanoscale. The virtue of the method consists in the possibility to derive and calculate the free energy of the system [3].

In the dynamical case, we propose a fully consistent formulation of the lattice Boltzmann method for two-phase fluids (liquid-vapor coexistence) [4]. To this end, one employs the Chapman-Enskog expansion up to the 3rd order and introduces a correction current to fulfill the continuity equation.

[1] K. M. Hong and J. Noolandi, Macromolecules , 14, 3, 1981.

[2] G. H. Fredrickson, The equilibrium theory of inhomogeneous polymers, Oxford, 2006.

[3] K. Ch. Daoulas and M. Müller, Soft Matter, 9, p. 4097, 2013.

[4] J. Zelko and B. Dünweg, Phys. Rev. E (accepted), arXiv:1402.2920, 2014.

CPP 46.9 Wed 10:00 Poster A

Modelling surface binding and dissociation of biomolecules — •Daniel Kappe[1,2], Andreas Hütten[1], and Christian Schröder[2] — [1]1Center for Spinelectronic Materials and Devices, Physics Department, Bielefeld University, Germany — [2]2Bielefeld Institute for Applied Materials Research, University of Applied Sciences Bielefeld, Germany

We performed computer simulations in order to study the binding kinetics of molecules which bind to or dissociate from a finite number of binding sites placed on a sensor surface. We modelled the process using a convection-diffusion equation together with a Robin boundary condition. We compared our results to experimental data obtained by Ritzefeld et al. [1] who studied the binding of PhoB to a functionalized surface by surface plasmon resonance studies. Furthermore, we conducted a parameter sweep which allows us to estimate the rate constants of association and dissociation.

CPP 46.10 Wed 10:00 Poster A

Cell wall sculpting and microflows in plants and insects. — •Desislava Todorova[1] and Eleni Katifori[1,2] — [1]Max-Planck Institute for Dynamics and Self-Organization, Göttingen, Germany — [2]Department of Physics and Astronomy, University of Pennsylvania, Philadelphia, USA

Remarkably similar types of corrugated architecture have evolved on the internal surfaces of the organs serving for fluid distribution in vascular plants and insects. We focus on examining the relation between the geometric properties of the xylem vessels of plants and the tracheal cells of insects and their functional adaptation for maximizing water flow and gas delivery and exchange, respectively.

We use computational fluid dynamics techniques to study the low Reynolds number flows which naturally occur in such systems and discuss configurations corresponding to optimal functionality.

CPP 46.11 Wed 10:00 Poster A

Spontaneous Formation of Nanopatterns in Velocity-Dependent Dip-Coated Organic Films: From Dragonflies to Stripes — Tomas P. Corrales[1], Mengjun Bai[2], Valeria del Campo[1], Maria Retamal[1], Moshe Deutsch[3], Haskell Taub[2], Klaus Knorr[1], Ulrich G. Volkmann[1], and •Patrick Huber[1,4] — [1]Fac. de Fisica, Pont. U. Santiago, 7820436 (Chile) — [2]Physics and Astronomy Dep., U. of Missouri, Columbia, Missouri 65211 (USA) — [3]Physics Dep., Bar-Ilan U., Ramat-Gan 52900 (Israel) — [4]Materials Physics, Hamburg U. of Technology, D-21073 Hamburg (Germany)

We present a study of thin, n-alkane films on the native oxide layer of a silicon surface, prepared by dip-coating in a n-$C_{32}H_{66}$/n-heptane solution. Electron micrographs reveal two distinct adsorption morphologies depending on the substrate withdrawal speed v. For small v, dragonfly-shaped molecular islands are observed. For a large v, stripes parallel to the withdrawal direction are observed. These have a few hundred micrometer lengths and a few-micrometer lateral separation. Grazing incidence X-ray diffraction and atomic force microscopy show that both patterns are monolayers of surface-normal-aligned C32 molecules. With increasing v, the surface coverage first decreases, then increases for $v > v_{cr} \sim 0.15$ mm/s. The critical v_{cr} marks a transition between the evaporation regime and the entrainment regime. The stripes' strong texture and the well defined separation are due to an 2D crystallization in narrow liquid fingers, which result from a hydrodynamic instability in the dip-coated films, akin to the tears of wine phenomenology, see also T. Corrales et al., ACS Nano 8, 9954 (2014).

CPP 46.12 Wed 10:00 Poster A

Generation of ultra-stable flows for microfluidic devices — •Annemarie Lüdecke[1] and Stefan Diez[1,2] — [1]B Cube - Centre for Molecular Bioengineering, TU Dresden, Arnoldstr. 18, 01307 Dresden, Germany — [2]Max Planck Institute for Molecular Cell Biology and Genetics, Pfotenhauerstr. 108, 01307 Dresden, Germany

In the fast growing field of microfluidics, pumps are essential elements. Notably, the most common pumping system, the volume-driven syringe pump, has two major limitations: (1) the amount of fluid that can be displaced is limited to the syringe volume and (2) the steadiness of the flow is limited by a combination of the step width of the pump motor and the syringe diameter.

Alternative pumping systems, not facing these limitations, rely on pressure differences. When driven by gas pressure, usually requiring external pressure sources like a compressor or a gas bottle, or by osmotic pressure, these pumps require extensive instrumentalization and are comparatively expensive.

When driven by gravitational forces, these pumps often lack long-term steadiness of flow rates. As the fluid moves from the inlet towards the outlet, the height difference equilibrates and hence the driving force diminishes. Here, we present a novel, low-instrumentalization and low-cost method for maintaining an ultra-stable gravitation-driven flow over extended periods of time.

CPP 46.13 Wed 10:00 Poster A

Switchable imbibition in nanoporous gold — •Yahui Xue[1,2], Juergen Markmann[1], Huiling Duan[2], Joerg Weissmueller[1,3], and Patrick Huber[3] — [1]Institute of Materials Research, Materials Mechanics, Helmholtz-Zentrum Geesthacht, D-21502 Geesthacht, Germany — [2]State Key Laboratory for Turbulence and Complex Systems, Center for Applied Physics and Technology, Peking University, Beijing 100871, China — [3]Institute of Materials Physics and Technology, Hamburg University of Technology, D-21073 Hamburg, Germany

Spontaneous imbibition enables the elegant propelling of nano-flows because of the dominance of capillarity at small length scales. The imbibition kinetics are, however, solely determined by the static host geometry, the capillarity, and the fluidity of the imbibed liquid. This makes active control particularly challenging. Here we show for aqueous electrolyte imbibition in nanoporous gold that the fluid flow can be reversibly switched on and off through electric potential control of the solid-liquid interfacial tension, that is, we can accelerate the imbibition front, stop it, and have it proceed at will. Simultaneous measurements of the mass flux and the electrical current allow us to document simple scaling laws for the imbibition kinetics, and to explore the charge

transport in the metallic nanopores. Our findings demonstrate that the high electric conductivity along with the pathways for fluidic/ionic transport render nanoporous gold a versatile, accurately controllable electrocapillary pump and flow sensor for minute amounts of liquids with exceptionally low operating voltages - see also Y. Xue et al., *Nature Comm.* 5, 4237 (2014).

CPP 46.14 Wed 10:00 Poster A

Thermocapillary Convection in Microfluidic Devices — •Lorenz Butzhammer and Werner Köhler — Physikalisches Institut, Universität Bayreuth, 95440 Bayreuth, Germany

Thermocapillary convection has been investigated experimentally at a liquid-air interface in a PDMS-based microfluidic device. Fluid dynamics in the vicinity of the meniscus, which is located at a T-junction of the 100-μm-wide channels, is observed using an inverted light microscope. A temperature gradient along the interface is set up through a focused laser beam (532 nm) and an absorbing dye at a low concentration. This leads to tangential Marangoni stresses and liquid flow towards regions with lower surface tension. Samples included water, ethanol, glycerol and binary mixtures of those with polystyrene beads (d = 100-600 nm) for flow visualization. Data evaluation was done using Particle Image Velocimetry (PIV) and Ghost Particle Velocimetry (GPV). Experiments show that the effect is absent in water and water-glycerol mixtures within the investigated temperature range. However, in ethanol, asymmetric convection rolls perpendicular to gravity already arise without an external heat source. The flow strength and direction can be manipulated by laser heating, leading to fluid motion towards lower temperatures. In symmetric mixtures containing ethanol the direction is reversed. Moreover, the onset and strength of the self-induced convection rolls at these concentrations strongly depend on repositioning of the meniscus.

CPP 46.15 Wed 10:00 Poster A

Equilibration of liquid morphologies in granulates with various wettability — •Marc Schaber[1], Mario Scheel[3], Martin Brinkmann[2], and Ralf Seemann[1,2] — [1]Experimental Physics, Saarland University, D-66041 Saarbrücken — [2]MPI for Dynamics and Self-Organization, Am Faßberg 17, D-37073 Göttingen — [3]European Synchrotron Radiation Facility, 6 rue Jules Horowitz, F-38000 Grenoble

When adding liquid to dry granulates, the liquid forms a network of capillary bridges and more complex liquid structures. Depending on wettability of the granules and geometry of the granular pile different liquid structures are formed. By means of ultrafast X-ray microtomography we explore the liquid equilibrium distribution emerging within granular packs. Monodisperse glass and basalt microspheres of different diameters are used as granules having small and large contact angle, respectively. By fluidizing the granulate, the packing geometry of the granules is changed and the liquid equilibrium structures are destroyed. We explore time resolved how the liquid is re-distributed and how the liquid morphologies are re-formed into a new equilibrium situation. We find a correlation between the bead diameter and the viscosity of the added liquid to the characteristic equilibration time. The absence of the equilibrium process for non-wettable beads indicates that the liquid redistribution proceeds via a thin liquid wetting film on the surface of the beads.

CPP 46.16 Wed 10:00 Poster A

Droplet morphologies upon volume change on structured substrates — •Carsten Herrmann[1], Ciro Semprebon[2], Martin Brinkmann[1,2], and Ralf Seemann[1,2] — [1]Experimental Physics, Saarland University, 66041 Saarbrücken — [2]Max Planck Institute for Dynamics and Self-Organization, 37018 Göttingen

We experimentally investigate the general behavior of droplet morphologies sitting on micro-structured substrates upon volume change. The substrates provide groove geometries with triangular, rectangular and sinusoidal cross section. The droplet morphologies are characterized by their eccentricity, i.e. the ratio of width to length, as function of the number of wetted grooves. The eccentricity of small droplets wetting just a few grooves characteristically varies upon an increase in drop volume and arrives at a constant value for sufficiently large droplets. The morphological changes depend sensitively on the wettability, aspect ratio and geometry of the underlying grooved substrate. The experimental results are compared quantitatively with numerical results computed by minimizing surface energies.

CPP 46.17 Wed 10:00 Poster A

Application of rapid prototyping techniques to create microfluidic devices — •Fabian Schmid-Michels and Andreas Hütten — Center for Spinelectronic Materials and Devices, Physics Department, Bielefeld University, Germany

Microfluidic devices have applications as analytical systems or biomedical devices and are tools to study various (bio-)chemical reactions. Conventional methods for fabrication are etching glass or silicon, or soft lithography to create a mold for poly(dimethylsiloxane) (PDMS). Soft lithography needs several costly devices and chemicals. By replacing this process with 3D-printing methods like fused filament fabrication, the creation of the mold requires no more chemicals. By using bio-compatible materials it is also possible to directly print simple microfluidic channels for bio-applications. Print resolution below 0.3mm is difficult to achieve and needs careful tuning of the printer. Several techniques and materials are evaluated to achieve better print resolution.

CPP 46.18 Wed 10:00 Poster A

Force response of actively deformed polymer microdroplets: dependence on the solid/liquid boundary condition — •Jonas Heppe[1,2], Joshua D. McGraw[2], Roland Bennewitz[1], and Karin Jacobs[1,2] — [1]INM - Leibniz Institute for New Materials, D-66123, Saarbrücken, Germany — [2]Saarland University, Experimental Physics, D-66041, Saarbrücken, Germany

In fluid dynamics, the solid/liquid boundary condition can play a major role in the flow behavior of a liquid. For example, in the dewetting of identical polymer films on weak slip or strong slip substrates, large qualitative and quantitative differences are observed. Therefore, when applying an external load to a liquid resting on such substrates, the measured reaction forces and the ensuing flow should also depend on the boundary condition. We present atomic force microscopy measurements in which the reaction force of a cantilever is measured as the tip pierces liquid polymer micron sized droplets and films. These indentations are done on substrates with tuned slip. Accessing the size, depth and rate dependence of the resulting force distance curves, we show an influence of the slip condition on the dissipated energy and adhesion.

CPP 46.19 Wed 10:00 Poster A

Pickering-emulsion for catalytic reactions — •Dmitrij Stehl[1], Adrian Carl[1], Kornelia Gawlitza[1], Regine von Klitzing[1], Tina Skale[2], Anja Drews[2], Lena Hohl[3] und Matthias Kraume[3] — [1]Physikalische Chemie, TU Berlin, Straße des 17. Juni 124, 10623 Berlin — [2]Verfahrenstechnik in Life Sci. Eng., FB 2, HTW Berlin, Wilhelminenhofstr. 75 A, 12459 Berlin — [3]Verfahrenstechnik, TU Berlin, Frauenhoferstr. 33-36, 10587 Berlin

A Pickering-emulsion (PE) was reported by RAMSDEN in 1903 for the first time. S. U. PICKERING studied this type of solids-stabilized emulsions systematically. PEs can be used in medicine for drug delivery or for catalytic reactions, for example for the hydroformylation of long chained olefins (1-Dodecene) in a water in oil (w/o-) emulsion. In this study, the water droplets (water phase) which are surrounded by SiO2-nanoparticles as stabilizer, contain [HRh(CO)(TPPTS)3] (TPPTS = 3,3',3"-Phosphanetriyltris (benzenesulfonic acid) trisodium salt) as homogeneous catalyst. The solids-stabilized water droplets are emulsified in 1-Dodecene (oil phase). After the hydroformylation, the water droplets with the catalyst can be easily separated from the product by membrane filtration and used again for the next reactions. Preliminary experiments showed that an increase in amount of SiO2-nanoparticles led to an augmentation of the product yield (Tridecanal) and decrease the droplet size from 0,02 to 0,005 mm. An addition of surfactant (Triton X-100) at low concentration (< cmc) increases the product yield as well but has no effect on the droplet size, which is surprising.

CPP 46.20 Wed 10:00 Poster A

Inertial migration of elastic capsules in Poiseuille flow — •Kevin Irmer, Christopher Prohm, and Holger Stark — Institute of Theoretical Physics, Technische Universität Berlin, Hardenbergstr. 36, 10623 Berlin, Germany

The influence of inertia on the rheology of deformable particles such as capsules, vesicles and red blood cells in flow has attracted much interest over the last few years. Many applications in biology and medical sciences rely on inertial effects. Especially the separation of particles like cancer cells from red blood cells plays an important role.

Using Lattice-Boltzmann simulations, we study the dynamics of a single deformable capsule in microfluidic channels with rectangular cross sections for intermediate Reynolds numbers.

In the channel cross section the capsules migrate towards stable equilibrium positions. We find that the locations of these positions shift towards the channel center for increasing deformability of the capsule and decreasing inertia of the flow. In particular, they strongly depend on deformability quantified by the capillary number. Hence we present a new possibility to separate capsules and other deformable particles by size and deformability. For Reynolds numbers below 100, the equilibrium positions collapse onto a single master curve depending only on the Laplace number.

Finally we determine lift force profiles for channel cross sections with different aspect ratios. The profiles determine inertial migration in the cross section.