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Editorial
Fluids and Surfaces

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Fluids is pleased to present a Special Issue named "Fluids and Surfaces", a curated collection of ten research articles focused on capillary phenomena and the interaction between fluids and surfaces. In fact, the latter play a key role in a broad set of circumstances, ranging from natural ones to industrial applications, environment protection, and cultural heritage conservation. A deep understanding of the fluid behavior in such scenarios has therefore acquired an increasing importance in recent years, also due to the growing number of devices and processes that are based on engineered surfaces, porous media, and miniaturization involving microfluidics. In addition, the design of bulk materials has reached a high level of maturity, so the effort to reach further levels of improvement is leading to a shift towards surface engineering too.

Fluid-surface interactions are certainly not a new research field, but despite more than two centuries of studies, many aspects are still not thoroughly clarified for both static and dynamic conditions, particularly on innovative surfaces (by chemistry and/or morphology), within porous media, for complex fluids and when fluid dynamics, capillarity, and heat transfer are coupled. Wettability and adhesion for complex surfaces and/or complex fluids, fluids in porous media and the relationship between external wettability and in-pore behavior, capillarity-driven flows, reactive wetting and electrowetting, evaporation, Marangoni, and thermocapillary convection, drop impact onto liquid pools and still and moving films, drop impact onto heterogeneous or rough/engineered dry surfaces (including porous, flexible, and textile surfaces) are all open research topics. Furthermore, the development of advanced measurement techniques, down to the microscale, opens new possibilities for experimental investigation, while the advent of computational fluid dynamics offers new tools for modeling and simulation.

The articles collected in this Special Issue cover very different topics, with the aim of giving an overview about the many different aspects of research in this field.

Alazaiza et al. [1] experimentally studied the migration of non-aqueous phase liquids in porous media, which is of interest for prevention of groundwater pollution, by image processing pictures of capillary migration of diesel in a laboratory-scale sand column. Their results prove that image processing is a suitable technique to study this phenomenon and offered insight about the dynamic behavior of these fluids in porous samples.

Persaud et al. [2] developed a mathematical model for the fluid flow in a pleated membrane filter, which is a type of filter widely used and that may offer significant advantages with respect to other types, but whose design must be very careful to avoid or reduce the points of weakness. Their analytical model allows to describe the fluid flow across a whole pleated filter cartridge.

Roy et al. [3] experimentally studied osmosis between a saline droplet and a pool of pure water, across a cured polydimethylsiloxane membrane. They performed cycles of growth and evaporation, a process that can be of interest for desalination and separation for batteries, evaluating the drop volume and contact angle and providing models for the involved phenomena.

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Arthur [4] focused on coupled flow over and within a compact porous medium. Planar particle image velocimetry was used to acquire the fluid velocity field, from which all the quantities of interest were calculated. The results evidence how the compact porous medium induces large-scale anisotropy in the surrounding turbulent flow, which can be important in applications involving such scenario, from natural ones to heat transfer devices.

Kvamme [5] analyzed from the thermodynamic point of view the use of small alcohols as surfactants to promote hydrate formation, in addition to their more common use as hydrate inhibitors. The model results shed light on the thermodynamic stability of systems including water, methane, carbon dioxide, nitrogen, and ethanol.

Nemirovskaya and Khramtsova [6] analyzed the results of two cruise studies about aliphatic and polycyclic aromatic hydrocarbons in the bottom sediments within the Norwegian-Barents Sea basin, evaluating the anthropogenic input and the endogenous influence in the different regions, to explain the local anomalies in content and composition.

Medina et al. [7] used image processing to study the wetting behavior of functional acrylic surfaces obtained by scratching with sandpaper of different grit. Capillary rise and drop aspect were evaluated to evaluate the effect of the micro-grooves created by the scratching, which resembles those that are progressively created when using and cleansing commonly used surfaces.

Guilizzoni and Frontera [8] performed a computational fluid dynamics study of the impact of multiple water drops into large pools, to extend the classic results for single droplets. Specific focus was on the crater depth, which is one of the most important parameters to evaluate the influence of the drops on the pool, for example for pollution transport. The possible extension of classic models for single drop impact to the multiple drop impact scenario was also evaluated.

Grishaev et al. [9] performed experiments - using a high-speed camera—and created a semi-analytical model for film rupture due to drop impact, analyzing the needed energy and the viscous dissipation in the film and in the impinging drop. Their results offer new insight about the effect of the fluid viscosity and the dry spots that are formed after the drop impact.

Caruana et al. [10] studied the wettability of plates used in the recuperators of Indirect Evaporative Cooling systems. In fact, creating a uniform film of water on the plates significantly improves the performances, thus static and dynamic contact angles were experimentally investigated for three commercially used surfaces: one aluminum uncoated surface and the same surface covered with a standard epoxy coating and with a hydrophilic lacquer.

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