Editorial

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This is the closing issue of 2017, in which we offer eight distinctively unique scientific contributions. The collection comprises one communication and seven research articles. The first three papers are on contact angles and wetting phenomena, followed by two papers on coatings of biomaterials, a paper on manipulation of oxide layer of a titanium alloy, a paper on thin inorganic films and a final paper on nanocomposite polymer electrolytes.

Asymmetry of liquid droplets on rough and heterogeneous solid surfaces with fabricated microscopic patterns of grooves and strips has been observed and reported in the literature in the past. However, for the first time, a team from Israel led by Abraham Marmur demonstrates that a large liquid droplet prefers an axisymmetric shape on rough surfaces made of parallel microscopic grooves if forced to overcome mechanical barriers and reach the most stable thermodynamic state.¹ This observation – supported by experimentation – is an important development in the science of wetting on rough surfaces and we strongly recommend everyone who studies contact angles and wetting phenomena to read the paper by Cwickel *et al.*¹

Zhang and Kornev analyzed the wetting of ribbon-shaped fibers in comparison to cylindrical fibers.² In this interesting contribution, the authors show that the sharp edges of ribbons prevent formation of barrel-like drops characteristic of cylindrical fibers. They also demonstrate a transition from the liquid column to the clam-shell drops that are not controlled by liquid volume but by the contact angle. The authors explain this intriguing and surprising phenomenon through analysis of surface tension and capillary forces acting on the droplet.

Hundreds of publications on superhydrophobic surfaces and coatings were published in a variety of journals since the middle of the 1990s. In spite of this enormous progress, there are still market-driven demands for coatings that are durable, environmentally friendly and weather resistant. The research team led by Alidad Amirfazli designed a new coating made of siloxane resin reinforced with nanosilica.³ Chemical bonding between silica and resin was controlled using a tin catalyst. The authors demonstrate fabrication of this durable superhydrophobic coating on aluminum surface using a spraying technique.

Surface manipulation, modification or coating is commonly explored in engineering of medical implants. Shomali *et al.* examined the effect of poly(L-lactic acid) (PLLA) polymer on biodegradation and biocompatibility of zinc.⁴ Zinc and its alloys

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have been introduced in 2013 as a new class of biodegradable medical metal, whereas PLLA is biodegradable polymer commonly used in the medical field as a coating in drug-eluting vascular stents. Shomali *et al.* demonstrate a successful coating of zinc wire with a microscopic uniform film of PLLA that delays degradation of zinc implant in the vascular environment of rats. This polymer, however, reduces biocompatibility of the metal, a surprising outcome that was never reported in the literature in the past.

Magnesium alloys are very broadly investigated in the medical field for biodegradable implants. Their degradation rate, however, is much higher than for zinc, and many research laboratories have explored ways to reduce the *in vivo* degradation rate of magnesium by alloying this metal with other elements and by modifying surfaces of magnesium and magnesium alloys. Kwas *et al.* describe *in vitro* cytotoxicity testing on a magnesium alloy containing manganese, cerium and lanthanum elements (MnE21), an alloy that is used in lightweight construction applications but was never tested for medical applications.⁵ Additionally, the authors coated the alloy with calcium and phosphate ceramic using plasma electrolytic oxidation method. The authors report unexpectedly high cytotoxicity of coated and uncoated MnE21, which suggests limited, if any, application of this alloy in the medical field.

Li *et al.* explore manipulation of oxide film on the surface of Ti-6Al-4V alloy through multiple surface rolling and thermal oxidation steps.⁶ This titanium-based alloy is a commonly used material for medical implants but the focus of work by Li *et al.* is on application of this alloy in airframe and aeroengine components. The authors demonstrate a combination of rolling and thermal treatment, which enhances tribological properties of alloy surface and reduces its susceptibility to wear. They accomplished superior oxide film structure by tuning fine grain formation.

The research team led by Dingyu Yang demonstrates success in deposition of cadmium sulfide (CdS) film on quartz using magnetron sputtering technique.⁷ The CdS films are commonly used as windows in solar cells. The authors studied a temperature dependence on structural and photoelectric properties of deposited CdS film, and they show in their publication that increased temperature applied to quartz promotes thin film crystalline quality with purer phase and lower defects concentration. This engineering achievement leads to enhanced structural and photoconductivity properties of deposited CdS film.

High ionic conductivity of electrolytes is beneficial to performance of supercapacitors, batteries, fuel cells sensors and other devices. Sharma *et al.* formulated a nanocomposite polymer electrolyte using poly(vinylidene fluoride-co-hexafluoropropylene).⁸ They report four order of magnitude increase in ionic conductivity of the polymer electrolyte with addition of dimethylformamide as a plasticizer and further improvement in conductivity with addition of nanoalumina as a filler.

We hope that the variety of research topics offered in this issue makes this collection unique and attractive to many of our readers.

Please feel free to email questions, comments and suggestions on the content of this, previous and future issues.

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