

Editorial

Jaroslav Drellich
Houghton, MI, USA



The second issue of 2016 offers five contributions on a variety of topics including sol–gel coatings,¹ assessment of organic coatings using a novel AFM-based method,² sorption of urea and caffeine by a metal–organic framework (MOF),³ coating of porous silica monolith with zeolite nanoparticles⁴ and liquid-infused surfaces.⁵

Hybrid coatings made of organic matrix and inorganic fillers provide unique structures and corrosion protection that have attracted the attention of researchers in recent years, as summarized in a comprehensive review by Zhang *et al.*¹ The authors argue that among the many methods for deposition of composites, the sol–gel process is probably the most investigated for formulation of environmentally friendly anticorrosion coatings. The review concentrates on siloxanes-based organic–inorganic hybrid sol–gel coatings for corrosion protection of aluminum alloys. The main factors that influence the anticorrosion performance of the formulated coatings are well analyzed and discussed in this review and include hybrid coating composition, processing parameters, selection of crosslinking agents, size of inorganic filler particles, and presence of corrosion inhibitors for self-healing of coatings. The authors conclude this timely review with limitations and challenges for the sol–gel coatings.

Local impedance imaging and spectroscopy of surfaces using contact atomic force microscopy (AFM) was invented more than a decade ago. Nevertheless, the use of this AFM-based method for assessment of quality and degradation of polymeric coatings dates back to 2010 and was proposed for the first time at Gdańsk University of Technology in Poland. Dr. Szociński is one of the co-inventors of this application. In the second paper of this issue, Szociński describes this novel AFM-based local impedance imaging and spectroscopy method and its potential in imaging of topography and recording local electrical characteristics for thin polymeric coatings.² The imaging and analysis of a coating by what could be called ‘nanoimpedance microscopy’ can be carried out *in situ*, during corrosion in electrolytes, and for post-corrosion coatings. This interesting short overview should be of interest to a broad range of materials and surface scientists.

Owing to their large specific surface area, MOFs have recently been considered as promising candidate porous materials for drug sorption and storage as discussed by Loera-Serna *et al.*³ The authors report the application of the Cu₃(BTC)₂ MOF in sorption of the pharmaceutical products of urea and caffeine with two strategies for retention of drugs, through *in situ* encapsulation (during MOF synthesis) and in post-synthesis encapsulation. Large square-shaped pores in the structure of the Cu₃(BTC)₂ MOF are sufficient in

dimension to hold molecules of urea and caffeine. The authors report that Cu₃(BTC)₂ MOFs with a specific surface area of 1500–1800 m²/g can adsorb caffeine and urea from water to a maximum load of ~52 and 30 wt%, respectively.

Hierarchical porous materials are in great demand and developments in this area could overcome limitations of microporous materials such as zeolites. Through organization of zeolites their active sites can be better exposed – enhancing the sorption and catalytic properties of these microporous materials. Gackowski *et al.*⁴ achieved a coating of porous silica monolith with layers of zeolite nanoparticles through manipulation of monolith–nanoparticle electrostatic interactions. For the strong silica–zeolite electrostatic interactions to take place in aqueous phase, the surfaces of these two materials were oppositely charged. Through adsorption of polycations, the close packing of zeolite nanoparticles on the surface of porous silica monolith, with formation of monolayer coverage, is demonstrated.

The engineering of liquid-infused surfaces made of porous and roughened solid constructs holding lubricating liquid has been pursued recently in the past few years. The liquid-infused surfaces and coatings filled with a constantly replenished lubricating liquid film are extremely slippery with low adhesion and a dynamic nature. Such surfaces hinder fouling, icing, scaling and wearing and could transform many engineering innovations if successfully designed. In the last contribution to this issue, Damle *et al.*⁵ offer a new route to lubrication and re-lubrication of polymeric liquid-infused surfaces. The unique inside-out-in approach in replenishing the fluid involves careful tuning of geometry of the internal polydimethylsiloxane fluidic network and an external pressure induced silicone oil re-lubrication system.

I hope you will find something interesting among the five papers included in this second issue of 2016 and would like to remind you that your feedback on the contents of *Surface Innovations* is always welcome.

REFERENCES

1. Zhang L, Zhang J and Liu R (2016) Organic–inorganic hybrid sol–gel coatings for corrosion protection of aluminum alloys. *Surface Innovations* 4(2): 51–69, <http://dx.doi.org/10.1680/jsuin.15.00013>.
2. Szocinski M (2016) Evaluation of organic coatings condition with AFM-based method. *Surface Innovations* 4(2): 70–75, <http://dx.doi.org/10.1680/jsuin.15.00007>.

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3. Loera-Serna S, Zarate-Rubio J, Medina-Velazquez DY, Zhang L and Ortiz E (2016) Encapsulation of urea and caffeine in $\text{Cu}_3(\text{BTC})_2$ metal–organic framework. *Surface Innovations* **4(2)**: 76–87, <http://dx.doi.org/10.1680/jsuin.15.00017>.
 4. Gackowski M, Bielanska E, Szczepanowicz K, Warszynski P and Derewinski M (2016) Deposition of zeolite nanoparticles onto porous silica monolith. *Surface Innovations* **4(2)**: 88–101, <http://dx.doi.org/10.1680/jsuin.15.00023>.
 5. Damle VG, Uppal A, Sun X, Burgin TP and Rykaczewski K (2016) On rapid and scalable lubrication and replenishment of liquid-infused materials. *Surface Innovations* **4(2)**: 102–108, <http://dx.doi.org/10.1680/jsuin.15.00002>.