coatings

Editorial

Special Issue: "Advances in Organic Coatings 2018"

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Received: 3 June 2020; Accepted: 9 June 2020; Published: 10 June 2020

Abstract: Organic coatings have shown an impressive evolution in recent years, both scientifically and technologically. Nanotechnology and surface science allows the development of multifunctional materials combining different properties, such as corrosion protective actions, aesthetical functions, hydrophobic properties, and self-healing ability. In addition, recent advances in experimental techniques and the attention to environmental issues are pushing to develop new systems, joining advanced performance with high sustainability. The aim of this Special Issue is to provide an update on the most advanced research in this area, showing the innovation trends and promoting further research for better properties of new coatings materials.

Keywords: flame-retardant coatings; corrosion protection; hydrophobic coatings; self-cleaning; bio-inspired materials

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The scientific and technological advances in organic coatings have been impressive over the last couple of decades, and recent further developments are opening new prospective for organic coatings science and technology [1]. New materials, based on nanotechnologies (nanostructured polymeric matrixes, nano-pigments), and new surface pretreatments improving the chemical and physical stability of the interfaces, are deeply modifying the performances of organic coatings [2–4]. Moreover, organic coatings are increasingly multifunctional. In addition to traditional functions, such as corrosion protective actions or aesthetical functions, modern organic coatings must often support additional roles: antibacterial activity, self-healing ability, and tribological properties, etc. [5]

The recent advances in experimental techniques (electrochemical methods, optical and electron microscopy, chemical surface analysis, and thermal analysis, etc.) applied to organic coatings provide a powerful tool for research and scientific development in this area [6]. Further driving forces pulling innovation into the organic coatings area are environmental issues. In order to develop new systems, joining advanced performance with high environmental sustainability, new materials are under development, anticipating future legislative requirements [7]. This frame is induced to consider the advances in organic coatings (the skin of materials) as one of the most interesting and promising innovation fields in material science.

The aim of this Special Issue is to provide an update on the most advanced research in this area, showing the innovation trends and promoting further research for better properties for new coatings materials. The eight papers composing the Special Issue [8–15] offer an interesting and broad overview of the developments in the science and technology of organic coatings from various and differentiated points of view.

Some works focus on a key point in the case of organic coatings: the interface—both the interface between the coating and the external environment (the surface of the material) [8,15], and the interface between the coating and the substrate [12]. The paper of Wasser et al. [15] describes the development of bio-inspired fluorine free synthetic replica of lotus and nasturtium surfaces in order to obtain self-cleaning properties. A UV curable acrylate oligomer and acrylated siloxane comonomers were used, combining the self-assembly of the comonomers and a replication step of the plant surfaces.

The texturization of the surfaces had a large influence on hydrophobicity and, as a result, a self-cleaning surface was obtained with very attractive application possibilities.

Hydrophobicity is also the topic of the paper proposed by Jankauskaitė et al. [8], where the improvement of the non-wetting properties of a flexible polydimethylsiloxane substrate surface via a plasma-polymerized hexamethyldisilazane thin film deposition by the arc discharge method is described. The film is composed of nanoparticles forming a branched network with self-cleaning and non-wetting behavior, demonstrating a new strategy for the large-scale fabrication of superhydrophobic surfaces with a self-cleaning function on flexible substrates.

Considering the substrate-coating interface, Nabavian et al. present a paper [12] assessing the influence of benzoimidazole concentrations on the cathodic delamination of epoxy coating applied on steel substrate. The results demonstrated that the cathodic disbonding resistance of epoxy-polyamide coating was dependent on the inhibitor content. Moreover, the interface stability, measured as the wet adhesion of the polymeric coating, was significantly enhanced through the addition of 0.75 wt.% benzoimidazole.

The Special Issue also presents interesting experimental work concerning newly formulated coatings [10] for special applications: edible coatings [13], flame-retardant coatings [14], and cultural heritage protection coatings [11].

Kozakiewicz et al. [10] present a simultaneous synthesis of aqueous silicone-acrylic and acrylic-silicone hybrid dispersions by different emulsion polymerizations. The hybrid dispersions showed good mechanical stability, narrow particle size distribution, and tended to form mechanically strong continuous coatings and films. The selected hybrid dispersions described in this paper can be applied as binders in the formulation of architectural paints that will be characterized by high water resistance and high surface hydrophobicity combined with high water vapor permeability.

Bernardino-Nicanor et al. [13] studied Opuntia Robusta Mucilage as a possible edible coating. FTIR analysis demonstrated important differences in the mucilage extracted from different tissues in terms of pectic content. In conclusion, this study showed that Opuntia Robusta Mucilage is a promising edible coating and that the tissue and extraction solvent influences mucilage characteristics.

The paper studying a new stratified flame-retardant coating, is presented by Beaugendre et al. [14]. A polymer blend composed of silicone of a curable epoxy resin and of a liquid functional filler successfully formed a double-layered coating, showing excellent adhesion to the polycarbonate substrate. The two phosphorus-based compound fillers were added to improve the flame-retardant properties.

Roncagliolo Barrera et al. [11] presented a paper characterizing organic coatings for cultural heritage artefact conservation using electrochemical noise. This technique is capable of assessing with great sensitivity the increase in corrosion-resistance performance conferred by the inhibitors added to protective coating. The addition of nicotine and caffeine to temporary protection demonstrated a high protection efficacy (that was better for nicotine than caffeine in acrylic coatings).

Finally, an important topic related to circular economy and material recycling is presented in the paper by Silva et al. [9], where the properties of post-consumer polyethylene terephthalate (PET) coating mechanically deposited on mild steels were presented. The mechanical deposition (press recycled) of the coating does no significant damage to the polymer and the PET organic coating presents good adhesion to the substrate as well as a high corrosion protection for carbon steel during long immersion times in aggressive solution. The PET organic coatings can be considered as an alternative, both for the PET recycling and for a new anticorrosive coating.

This Special Issue is a helpful tool for researchers working in the field, for appreciating the state of the art, and to provide an overview of the new innovative trends in the field of organic coatings science and technology.

Conflicts of Interest: The author declares no conflict of interest.

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