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Innovative superhydrophobic nano coatings for durable applications

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Statement of the Problem: Nowadays, superhydrophobic surfaces (Figure 1) are a hot topic of coatings research, due to their water-repellent and self-cleaning potential, first observed on lotus leaves. Biomimetic artificial coatings intend bringing together the double/multiple roughness of the natural self-cleaning surfaces and a hydrophobic coating that could mimic the wax properties covering the lotus leaves. The roughness of the surface plays an important role in obtaining high contact angles (> 150°); otherwise, it is impossible to exceed angles of 120°. This work proposes an innovative method to produce durable superhydrophobic coating films with self-cleaning features.

Methodology & Theoretical Orientation: This method uses raspberry-like silica-modified nanoparticles (Figure 1) for texturing the substrate surface and it is particularly suitable for thermosensitive and/or transparent surfaces, since the temperature of the coating process remains below 100°C.

Findings: The method comprises several steps: (1) texturing the surface, via deposition of innovative silica-modified nanoparticles of different sizes, (2) crosslinking the textured surface, via a crosslinking agent, and optionally, (3) surface modification by hydrophobic molecules. The coating hydrophobicity can be enhanced by optimizing the preparation process. Preliminary coating tests on transparent substrates confirm the efficiency of the applied strategy: water droplets in contact with such a textured surface are almost spherical, indicating a Cassie-Baster state, where the liquid is in direct contact only with the upper points of the roughness and with air pockets trapped between the liquid and the lower roughness points of the solid coating.

Conclusion & Significance: An innovative strategy for preparing textured superhydrophobic surfaces was presented. This method is inexpensive and simple to apply and it is particularly suitable for industrial applications needing self-cleaning coating features applied on thermosensitive and/or transparent surfaces/materials.

Biography

Daniela Rusu (M.Sci., Ph.D., HDR in Materials Science) is a Polymer Scientist at the Université de Haute-Alsace, Laboratoire de Photochimie et d'Ingénierie Macromoléculaires (LPIM), Mulhouse, France. Her research and teaching activities focuses on multiphase polymer systems (polymer blends, nanostructured materials, gels, composites…), in understanding the processing-structure-properties relationships and tailoring these complex polymer materials for targeted applications (biomedical applications, food packaging, transport, coatings…). Her current research focuses on advanced polymeric materials for coating and biodegradable polymers for medical and industrial applications. She co-authored 10 book chapters and over 100 articles on multiphase polymer systems in different peer-reviewed journals and proceedings. She is an active reviewer for peer-reviewed journals and a scientific expert for EU Framework Program Horizon 2020 for Research and Innovation.

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