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Superhydrophobic, amphiphobic industrial materials

Mariarosa Raimondo
Institute of Science and Tecnology for Ceramics ISTEC CNR, (Italy)

Among the different smart functions conferrable to metals, alloys, natural fibres and composites surfaces, super-hydrophobicity (SH, repellence to water) and amphiphobicity (AM, repellence to low surface tension liquids/fluids) have great potential in different industrial sectors - aerospace, marine and naval, mechanic, energy, etc. – since the designed anti-wetting/de-wetting performances could mean anti-fouling, de-icing/anti-icing attitude, corrosion resistance, drag friction and noise/vibration reduction, improvement of thermal exchange coefficient, etc, these latter as properties deriving from the "native" non-wetting state. In this work different design approaches to SH and AM glasses and ceramics, metals and alloys with extremely reduced surface energy is concerned by deposition of nano-oxides suspensions (particles diameter up to 30 nm) in alcoholic or water-based media, eventually coupled with perfluorinated, and/or lubricant compounds, providing the materials of *solid-liquid-air* or, alternatively, *solid-liquid-liquid* working interface. Optically transparent, nanostructured organic/inorganic hybrid coatings, with contact angles (CA) against water as high as 178°, CA with n-hexadecane (surface tension γ = 27 mN/m @ 20°C) in the 140-150° range and CA hysteresis lower than 5° have been produced. A full characterization of the surface chemistry has been undertaken by XPS analyses, highlighting the different coating's components in the hybrid structure, while FESEM observations allowed to estimate the coating's thickness (300-400 nm) and their structural features (flower-like lamellas, agglomeration of spherical nanoparticles, etc). In order to locate the potential field of industrial application, and not forgetting the durability issues, data on SH and AM surfaces as solutions for anti-icing, anti-soiling, drag and friction reduction, improvement of thermal exchange coefficient will be presented.

ghpourtaghi@yahoo.com