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Amphiphobic nanostructured coatings for industrial applications

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Today different industrial sectors - aerospace, marine and naval, mechanic, energy, etc. - need of innovative technical solutions allowing to reduce the surface wetting against water and low-surface tension liquids or fluids. Wettability depends in a complex way on structural and chemical features of surfaces interacting with the surrounding working environments and conditions. In the last years, a lot of studies have focused on the possibility of mimicking the ability of living organisms to repel water and oily substances by perfectly, mostly hierarchically, organized structures and a low surface energy chemical composition. This lecture will focus on the design of *amphiphobic* (superhydrophobic and oleophobic) glasses and ceramics, metals and alloys, by deposition of nano-oxides suspensions (particles diameter up to 30 nm) in alcoholic or water based media, eventually coupled with perfluorinated, 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). The correlation between the surface properties and the wetting performances will be analized in order to locate the potential field of industrial application. For this purpose, data on *amphiphobic* surfaces as solutions for anti-icing, anti-soiling, drag and friction reduction, improvement of thermal exchange coefficient will be presented.

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