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Atmospheric pressure plasmas for the design and tailoring of surfaces and coatings : from fundamental understanding to dedicated surface properties.

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Functional coatings can nowadays be synthesized by atmospheric plasma, which opens interesting possibilities for industrial applications. Antibacterial, anticorrosion, optically active, biocompatible, self-cleaning, superhydrophilic, superhydrophobic, sticky or repellent surfaces can be obtained. However, the still mostly empirical approach used (study of the change in the coating chemistry and properties as a function of the plasma parameters) and the many references to low pressure plasma polymerization theories lead to some limitations in the development of new coatings. In the talk we will present another approach, based on a deeper understanding of the physics and chemistry of the plasma itself, and its consequences on the growing film. The drastic effect of the chemistry of precursors and of the choice of the plasmagen gas (argon or helium) on the chemistry, texture and properties of the resulting coatings will be shown. Examples of fluorinated coatings, acrylates, PEG, and ion-exchange membrane films will be described. The plasma phase, or its post-discharge, is studied using atmospheric mass spectrometry (MS), optical emission spectroscopy (OES), and electrical measurements. The obtained coatings were characterized using infrared spectrometry (FTIR), X-ray photoelectron spectroscopy (XPS), secondary ion mass spectrometry (SIMS), (dynamic)water contact angle (WCA), atomic force microscopy (AFM), and profilometry.

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