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Hydrophobic and superhydrophobic surfaces fabricated using atmospheric pressure cold plasma technology: A review

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Abstract

Hydrophobic surfaces are often used to reduce wetting of surfaces by water. In particular, superhydrophobic surfaces are highly desired for several applications due to their exceptional properties such as self-cleaning, anti-icing, anti-friction and others. Such surfaces can be prepared via numerous methods including plasma technology, a dry technique with low environmental impact. Atmospheric pressure plasma (APP) has recently attracted significant attention as lower-cost alternative to low-pressure plasmas, and as a candidate for continuous rather than batch processing. Although there are many reviews on water-repellent surfaces, and a few reviews on APP technology, there are hardly any review works on APP processing for hydrophobic and superhydrohobic surface fabrication, a topic of high importance in nanotechnology and interface science. Herein, we critically review the advances on hydrophobic and superhydrophobic surface fabrication using APP technology, trying also to give some perspectives in the field. After a short introduction to superhydrophobicity of nanostructured surfaces and to APPs we focus this review on three different aspects: (1) The atmospheric plasma reactor technology used for fabrication of (super)hydrophobic surfaces. (2) The APP process for hydrophobic surface preparation. The hydrophobic surface preparation processes are categorized methodologically as: a) activation, b) grafting, c) polymerization, d) roughening and hydrophobization. Each category includes subcategories related to different precursors used. (3) One of the most important sections of this review concerns superhydrophobic surfaces fabricated using APP. These are methodologically characterized as follows: a) single step processes where micro-nano textured topography and low surface energy coating are created at the same time, or b) multiple step processes, where these steps occur sequentially in or out of the plasma. We end the review with some perspectives in the field. We aspire to address scientists, who will get involved in the fields of (super)hydrophobicity and / or in atmospheric pressure plasma processing.

Keywords: atmospheric pressure plasma; hydrophobic; superhydrophobic; water-repellent surfaces; plasma micro-nanotexturing

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