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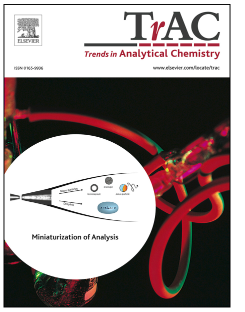

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Biological and chemical sensing applications based on special wettable surfaces

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Abstract

Special wettable surfaces (SWS, i.e., surfaces with special wettability) are less common in daily life. Some of the frequently studied SWS include those surfaces of homogeneous wettability which are superhydrophobic, superoleophobic, or omniphobic. Additionally, surfaces of patterned wettability which are partially hydrophilic and partially hydrophobic have also been widely investigated. Besides their wide applications in self-cleaning, anti-fogging, water-harvesting, anti-icing, water-oil separation and anticorrosion, the SWS have also been emergingly utilized in biological and chemical sensing in recent years. This review focuses on the SWS-based sensing applications, and classified them into electrical/electrochemical assays, surface-enhanced Raman scattering (SERS) assays, fluorescent/colorimetric assays, and visual assays (i.e. assays based on contact angle). After the main characteristics and performances of these applications were briefly summarized, areas to be improved and direction for future development of this research topic were discussed at the end of the review.

Keywords:

Biological/chemical sensing; Special wettable surface; Contact angle; Patterned wettability; Superhydrophobicity.

1. Introduction

The special wettable surfaces (SWS) typically refer to those surfaces of which the wetting properties (i.e., wettability) are not commonly encountered in daily life [1]. As a significant property of a solid surface [2], the wettability macroscopically represents the interaction between the substrate solid materials and the fluids or liquids [3]. The basis to study the wettability is the Young's equation which results from the initial study in 1805 [4], and the most direct way to determine the wettability of a surface is by measuring the water/oil contact angle (WCA/OCA) of a sessile liquid droplet on a solid surface in air [3, 5]. Different types of SWS and its corresponding CAs are listed in **Figure 1** [6-11]. With the fast development of material science, chemistry and some other related subjects, the fabrication/design and application of the SWS has become more and more diverse [12, 13]. Generally, the fabrication of the SWS proceeds from by creating a hierarchical rough microstructure, or by modifying the substrate with a layer of chemical coating [14]. And the applications of the SWS extensively covered the area of self-cleaning, anti-fogging, water-harvesting, anti-icing, water-oil separation, anti-corrosion and so