ISO/DTS 10689:2023(E)

ISO TC 229/SC/WG 5

Secretariat: BSI

Nanotechnologies — Superhydrophobic surfaces and coatings: Characteristics and performance assessment

Nanotechnologies — Surfaces et revêtements superhydrophobiques : caractéristiques et évaluation de la performance

ISO/DTS 10689:First edition

Date: 2023(E)-04-11

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Foreword

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~~1.2.1.1.1.1 ISO/DTS 10689:2023(E)~~

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Introduction

Surfaces or coatings which are extremely difficult to wet with water can be considered as superhydrophobic. Based on the scientific literature, superhydrophobic surfaces and coatings show contact angles of above ~~150º~~150° as well as contact angle hysteresis less than ~~10º.~~10°. Superhydrophobicity phenomena is seen in some natural species, e.g. lotus leaves. Other related terms are "lotus effect" which arises for droplets being in "Cassie-Baxter" wetting state.

Various methods have been utilized for the production of superhydrophobic surfaces and coatings, e.g. chemical vapour deposition, spin coating, sputtering, plasma deposition, chemical etching, sol-gel, photolithography, anodizing~~,~~ and plasma electrolyte oxidation. The superhydrophobic surfaces and coatings have numerous applications in different industries due to their properties, which can include self-cleaning, anti-corrosion, anti-icing, anti-fog~~,~~ and antibacterial effects. Such coatings and surfaces are gradually entering automotive, building and construction, healthcare, optical and electrical industries. The market for superhydrophobic surfaces and coatings for 2020 was about $1~~.~~,8 billion~~.~~[1].

A common characteristic of superhydrophobic surfaces and coatings is their proper two-level topography (i.e. micro- and nano-sized asperities) combined with low surface energy. This multiscale (hierarchical) roughness would result in large water contact angle, low contact angle hysteresis, and high wetting stability against the Cassie–Baxter to Wenzel transition. In other words, a large contact angle is already achievable with a microscale surface roughness but for having a large contact angle combined with small contact angle hysteresis, nanoscale roughness is needed~~.~~[3]. In other words, water cannot penetrate into nano-scale surface asperities which results in small contact angle hysteresis. In the absence of nano roughness, penetration of water into the micro-scale surface asperities results in high contact angle hysteresis (see ~~Appendix~~Annex A). Such surfaces (surfaces with contact angles above ~~150º~~150° and contact angle hysteresis more than ~~10º)~~10°) are called "pseudo-superhydrophobic" surfaces~~; other~~[3]; another related term for pseudo-superhydrophobic is: "sticky superhydrophobic" that arises due to the rose petal effect for droplets being in the Wenzel state.

Water droplets easily bead up and roll-off on superhydrophobic surfaces and coatings and this easy roll-off is the root cause of all the interesting properties of superhydrophobic surfaces and coatings. Advancing and receding angles are the parameters used to quantify the droplet mobility on surfaces. As such, measuring the advancing and receding angles identify if a coating/surface has superhydrophobic properties. Also, measuring the advancing and receding angles before and after exposing the surface to different working/environmental conditions can be used to assess the performance of superhydrophobic surfaces and coatings.

The superhydrophobic surfaces and coatings are normally subjected to different working/environmental conditions, ~~e.g.~~for example, mechanical stress, ultra-violet (UV), visible and infrared (IR) exposure, exposure to different liquids~~,~~ and thermal cycling. These conditions may lead to possible alteration of the performance of superhydrophobic surfaces and coatings. Unfortunately, despite the huge market, there is currently no standard to assess the durability of superhydrophobic surfaces and coatings. This ~~TS~~document aims to specify performance assessment methods of superhydrophobic surfaces and coatings under different working/environmental conditions, where applicable based on the agreement between interested parties. The assessment criteria are comparison of advancing angle, receding angle and contact angle hysteresis of the samples before and after being subjected to the above-mentioned working/environmental conditions. Further, this ~~TS~~document facilitates the communication between the interested parties. Also, this ~~TS~~document supports UN sustainable development goals (SDGs) 8 and 12 which are "decent work and economic growth" and "responsible consumption and production".