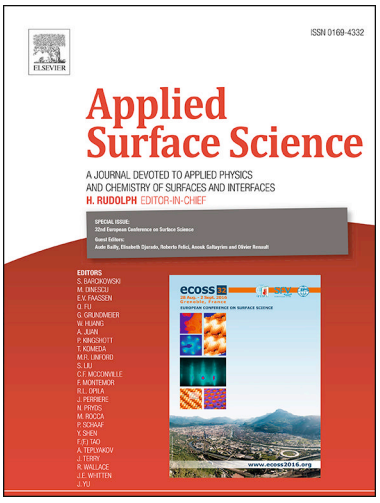
Accepted Manuscript



Full Length Article

Fabrication of stable fluorine-free superhydrophobic fabrics for anti-adhesion and self-cleaning properties

S. Foorginezhad, M.M. Zerafat

PII: S0169-4332(18)32474-7
DOI: https://doi.org/10.1016/j.apsusc.2018.09.058
Reference: APSUSC 40362

To appear in: *Applied Surface Science*

Received Date: 19 June 2018
Revised Date: 15 August 2018
Accepted Date: 6 September 2018

Please cite this article as: S. Foorginezhad, M.M. Zerafat, Fabrication of stable fluorine-free superhydrophobic fabrics for anti-adhesion and self-cleaning properties, *Applied Surface Science* (2018), doi: https://doi.org/10.1016/j.apsusc.2018.09.058

Fabrication of stable fluorine-free superhydrophobic fabrics for anti-adhesion and self-cleaning properties

S. Foorginezhad, M.M. Zerafat*

Faculty of Advanced Technologies, Nano-Chemical Engineering Department, Shiraz University, Shiraz, Iran

* mmzerafat@shirazu.ac.ir

Abstract

This study is aimed at the fabrication of superhydrophobic fluorine-free films on cotton fabrics through incorporating a rough sub-structure followed by chemical modification. Stable titania hydrosols were prepared via sol-gel using 0.44 mol/L titanium tetraisopropoxide in acidic media followed by chemical modification of the sol using vinyltrimethoxysilane (VTMS) for surface energy reduction and spraying over the surface. Upon drying at 60 °C, covalent attachment of vinyl modified TiO_2 particles to hydrophilic surface was occurred. Water contact angle increased from 0° on pure fabric up to 134.1° with sliding angles >90°. Further enhancement in water contact angles up to ~170° and reduction of sliding angle to <10° was achieved by introduction of polydimethylsiloxane (PDMS). Hydrodynamic particle size of TiO_2 sol was determined using dynamic light scattering (DLS). Scanning electron microscopy (SEM), energy dispersive X-ray (EDX) and Attenuated total reflectance-Fourier Transform Infra-Red (ATR-FTIR) analyses were conducted to verify the morphology and rough structure, elemental analysis and surface chemical modification of treated surfaces, respectively. Furthermore, the superhydrophobic coating was applied on a commercial sponge for oil-water separation. According to the results, self-cleaning, anti-adhesion, chemical resistant and durable super-hydrophobic fabric was prepared through spraying of low-cost environmentally friendly materials.

Keywords; Super-hydrophobicity, Self-cleaning, PDMS, Sliding angle, Surface energy

1. Introduction

Self-cleaning, long life-time and anti-wetting properties of solid surfaces are related to surface wettability characteristics governed by surface free energy and geometrical structure. Wettability is specified by measuring the water contact angle (WCA) which is considered as superhydrophobic or nonwetting in case of θ>150° and water sliding angles (WSA) < (5-10)° [1-