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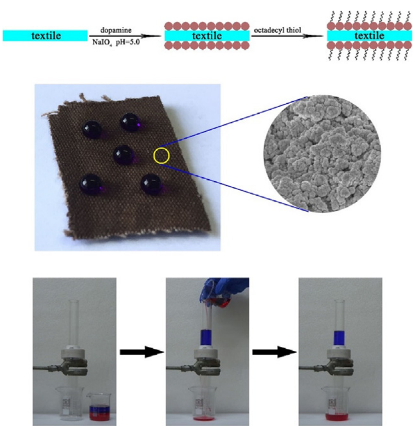
A facile method to mussel-inspired superhydrophobic thiol-textiles@polydopamine for oil/water separation

Lufeng Chen[a,b], Zhiguang Guo[a,b,*]

[a] Hubei Collaborative Innovation Centre for Advanced Organic Chemical Materials and Ministry of Education Key Laboratory for the Green Preparation and Application of Functional Materials, Hubei University, Wuhan 430062, People's Republic of China

[b] State Key Laboratory of Solid Lubrication, Lanzhou Institute of Chemical Physics, Chinese Academy of Sciences, Lanzhou 730000, People's Republic of China

GRAPHICAL ABSTRACT



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ABSTRACT

Due to the poor mechanical stability, the practical applications of superhydrophobic materials are limited. Inspired by the excellent adhesion of polydopamine (PDA), a kind of superhydrophobic coating is successfully fabricated on the textile. Herein, under weak acidic conditions (pH = 5.0), sodium periodate is selected as oxidant and the concentration of dopamine is controlled at 8 mg/mL, which leads to the fast and homogeneous deposition of PDA nanoaggregates on the pristine textile. Subsequently, the nanoaggregates are modified by octadecyl thiol. The PDA nanoaggregates work as a stable bond between the pristine textile and hydrophobic groups introduced from thiol, which contributes to the mechanical stability of the superhydrophobic textile. In addition, the superhydrophobic textiles display resistance to acetone, UV irradiation, and hot water. Significantly, the textiles can be used for oil/water separation with flux around 4500 $L m^{-2} h^{-1}$ and the separation efficiency more than 97%. These advantages provide the superhydrophobic textiles with multiple applications.

* Corresponding author at: Hubei Collaborative Innovation Centre for Advanced Organic Chemical Materials and Ministry of Education Key Laboratory for the Green Preparation and Application of Functional Materials, Hubei University, Wuhan 430062, People's Republic of China.

E-mail address: zguo@licp.cas.cn (Z. Guo).

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1. Introduction

Superhydrophobic surface, generally defined as one kind of surface with a static water contact angle larger than 150° and a sliding angle lower than 10°, has attracted more and more attention due to its water-repellent property and potential application values [1–3]. Studies on the phenomenon of superhydrophobicity can be traced back to the famous Wenzel and Cassie equations [4,5]. It is worth mentioning that some organisms in nature, such as lotus leaves, water strider legs, and butterfly wings, possess excellent superhydrophobic properties [6,7].

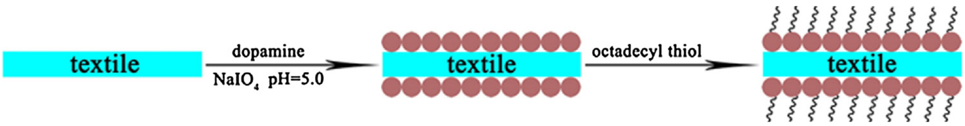

Fig. 1. Schematic illustration for fabrication of superhydrophobic coating on the textile.

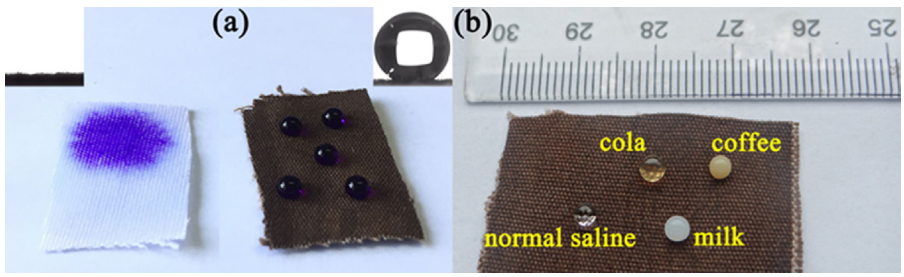

Fig. 2. (a) Photographs of the pristine textile (left) and the superhydrophobic textile (right). Optical images of the static water droplets are shown in the insets. (b) Shapes of different droplets on the superhydrophobic textile.

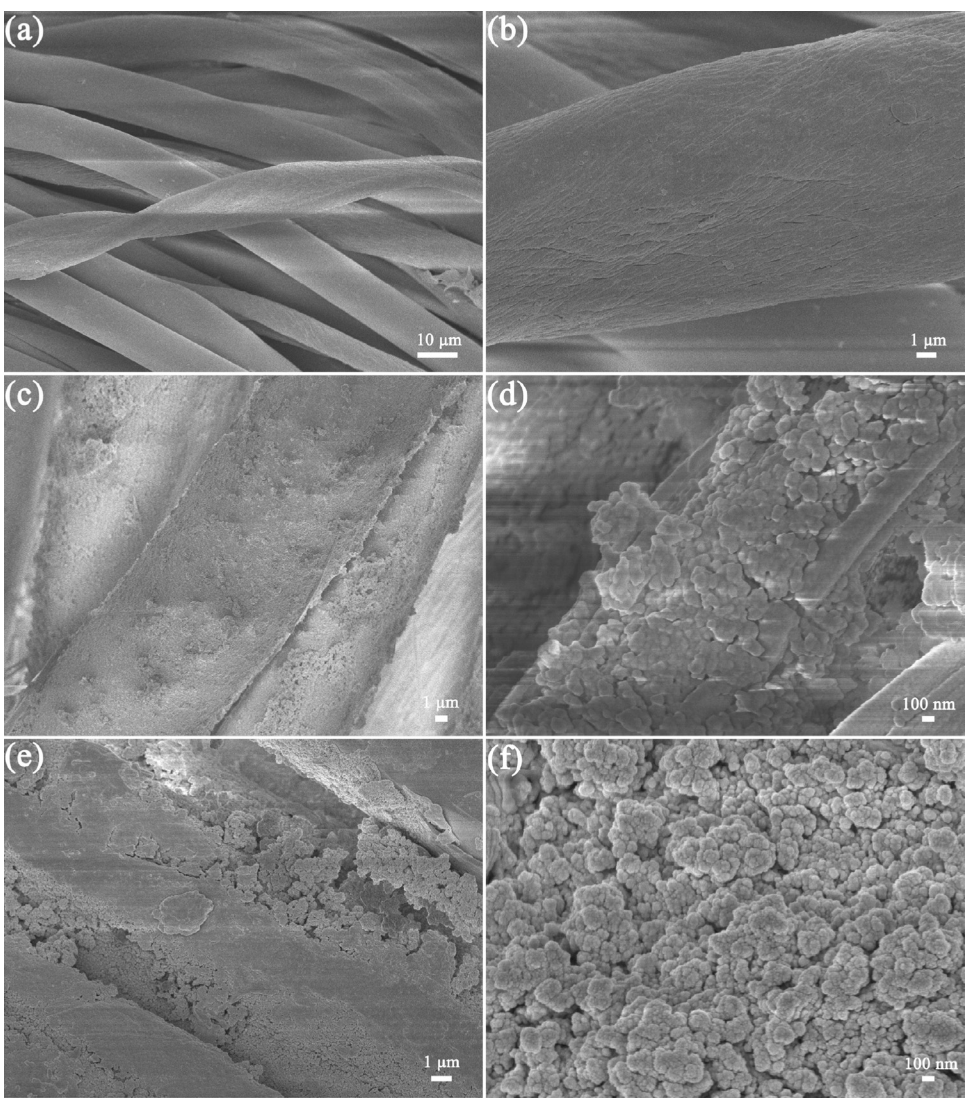

Fig. 3. SEM imagines of the pristine textile (a, b), the PDA-coated textile (c, d), and the superhydrophobic textile (e, f).