Study on Construction and Properties of Self-cleaning Leather

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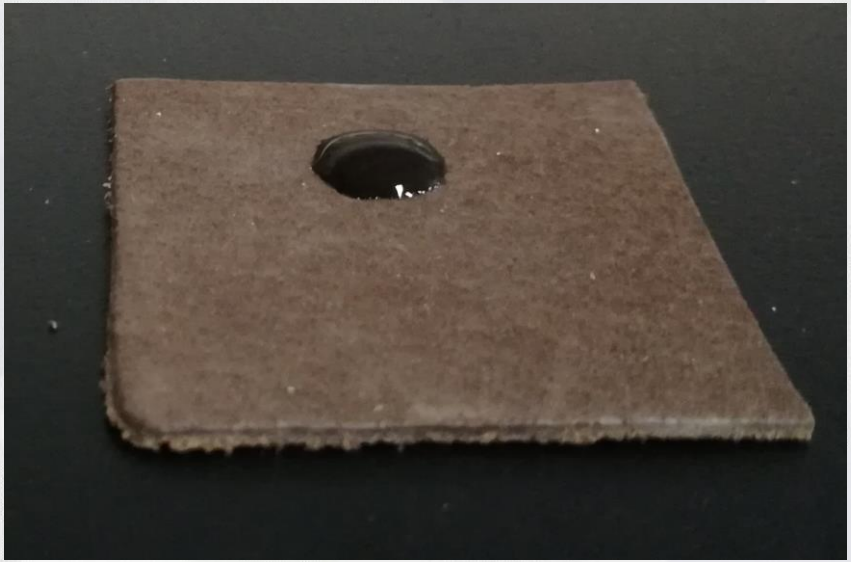
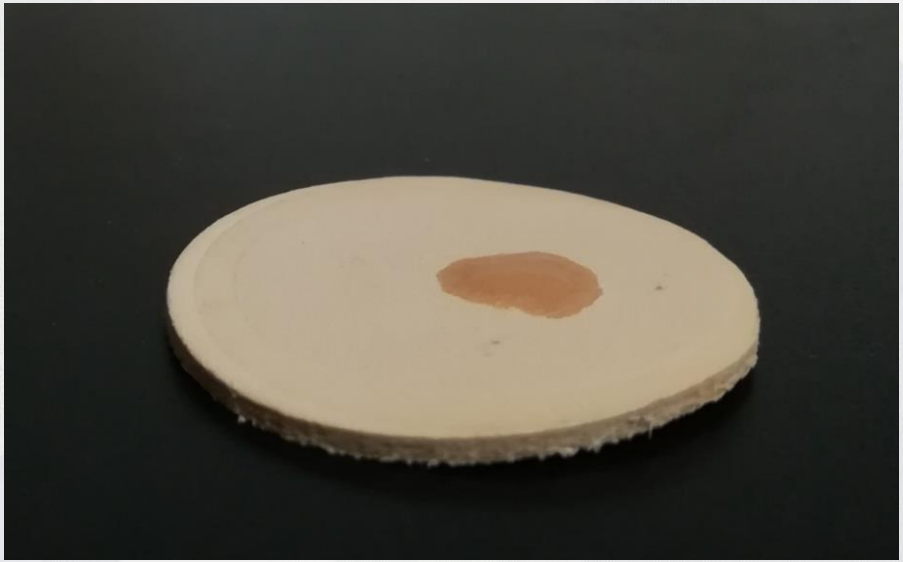
Speaker information-brief introduction

- ➢ **Full-time position: Director of biomass and Tanning Department, Qilu University of Technology, Dr.**
- ➢ **Part-time position：**
- ✓ **Standing member of Technical Committee of China Leather Association.**
- ✓ **Member of expert bank of China Shoemaking Union.**
- ✓ **Chief engineer of Jiangsu Dunwang Technology Group Co., LTD.**
- ➢ **Technology specialty: functional polymer material, functional leather product.**

Research Background---
Waterproof and antifouling effect picture of traditional leather





Research Background---

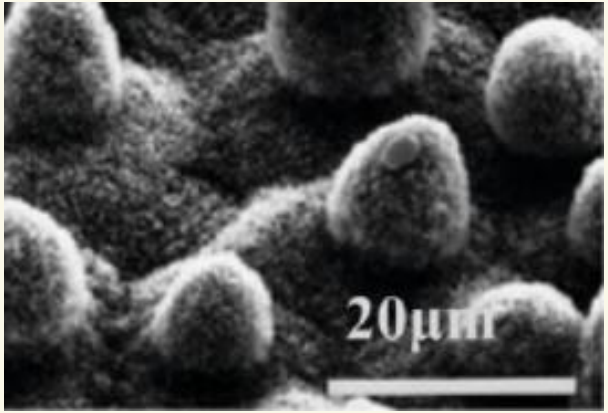
Waterproof and antifouling effect picture of traditional leather shoes and boots

Research Background---
Waterproof and antifouling effect picture of self-cleaning leather shoes

Research Background-Self-cleaning principle

Lotus leaf: “rising unsullied from mud”

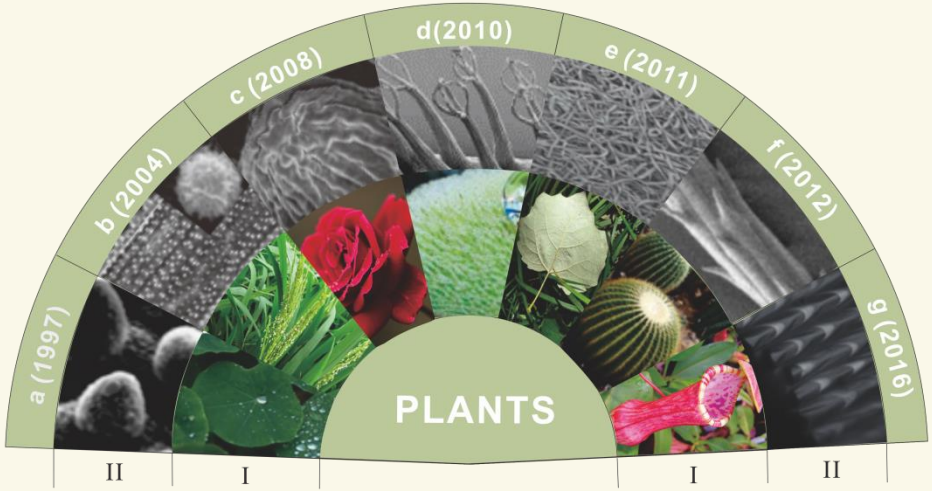
——the self-cleaning effect of the surface of lotus leaf



Why?

--- Linear or hairy micron convex bodies and waxy substances with low surface energy on the surface of lotus leaves

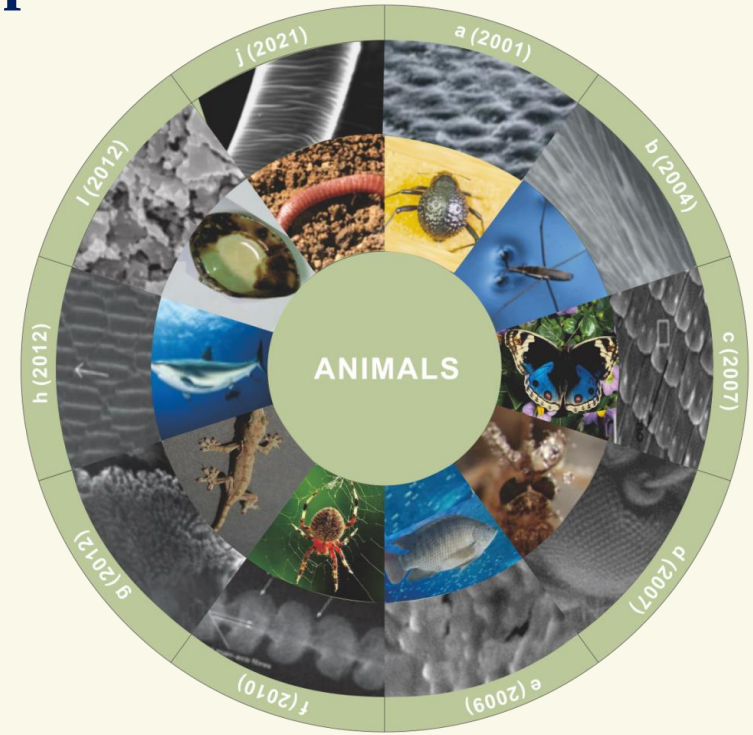
Research Background-Self-cleaning plant bionics



Typical plants (Tape I) with special surfaces and corresponding micro-nano structures (Tape II).

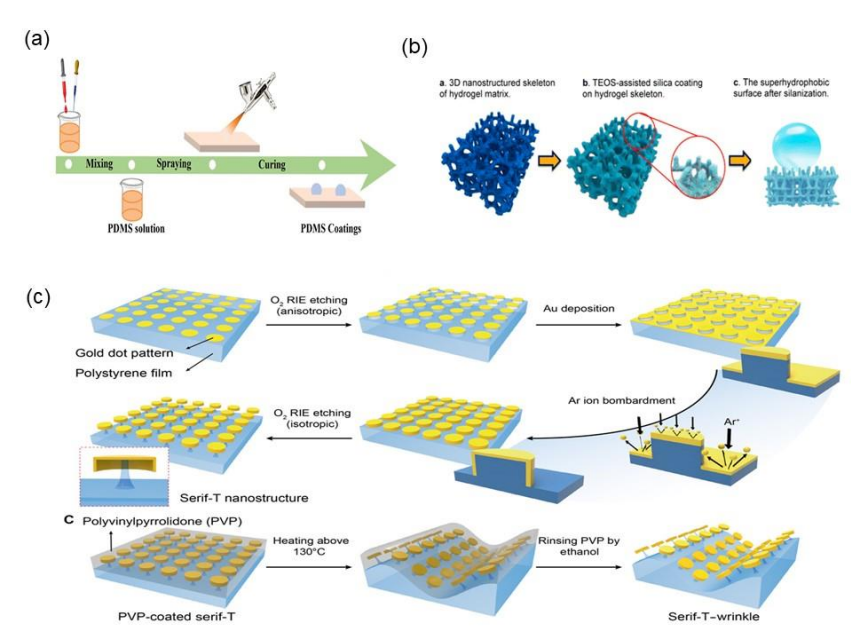
(a) Lotus leaves (b) Rice (c) Red roses (d) Salvinia leaves (e) Poplar leaves (f) Cactus (g) Porphyra

Research Background-
Self-cleaning plant bionics



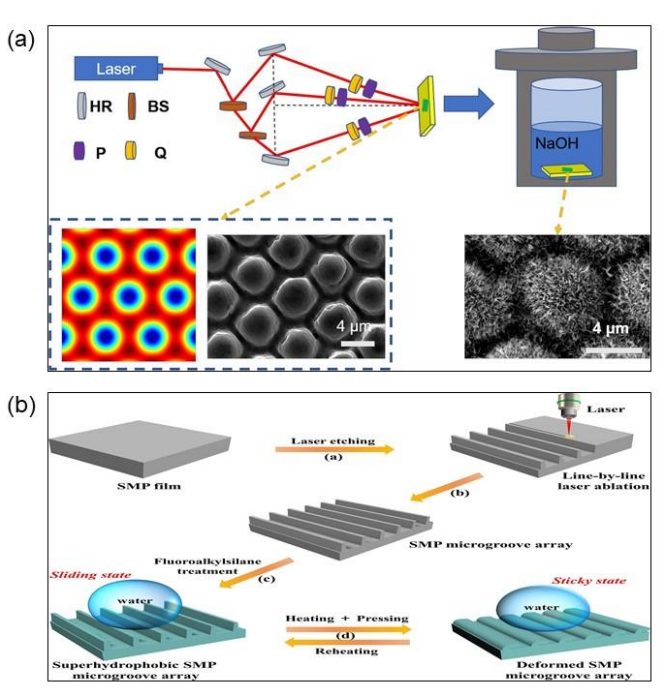
Typical animals(Inner ring) with special surfaces and corresponding micro-nano structures(Outer ring).
(a) Stenocara beetles . (b) Water strider legs . (c) Butterfly wings . (d) Mosquito compound eyes . (e) Fish scale . (f) Spider silk . (g) Gecko feet . (h) Shark skin (i) Clam shell . (j) Earthworm Skin

Construction method of self-cleaning coating – spray coating and wipe coating



(a) Schematic diagram of the preparation of hydrophobic PDMS coating matrix.
(b)Schematic description of superhydrophobic surfaces templated from a hydrogel matrix.
(c) Preparation steps of a springtail-inspired serif-T shaped textured surface by lithography and wrinkling

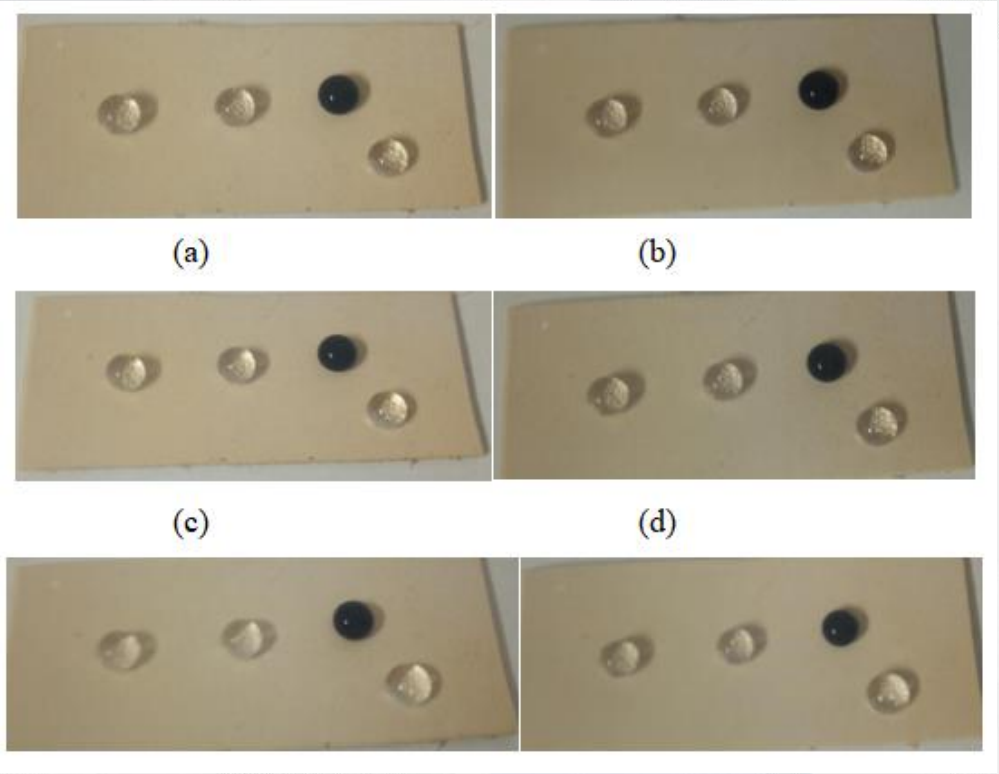
Construction method of self-cleaning coating
- etching method

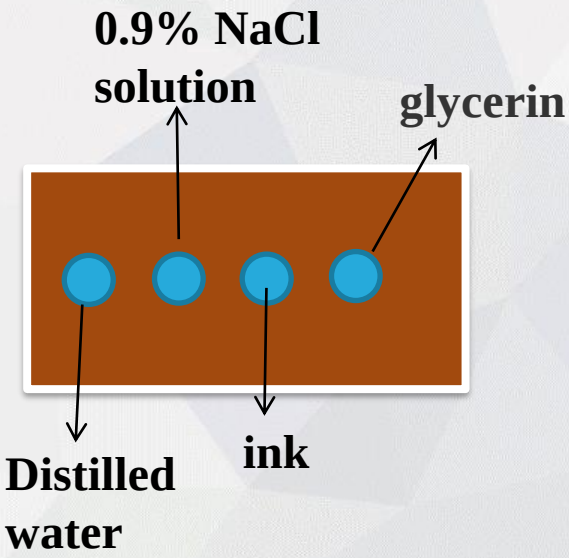


(a) Fabricating bionic taro leaf surfaces by DLIL and hydrothermal treatment.

(b) Schematic diagram of anisotropic superhydrophobic SMP microgroove arrays fabricated by selective femtosecond laser etching.

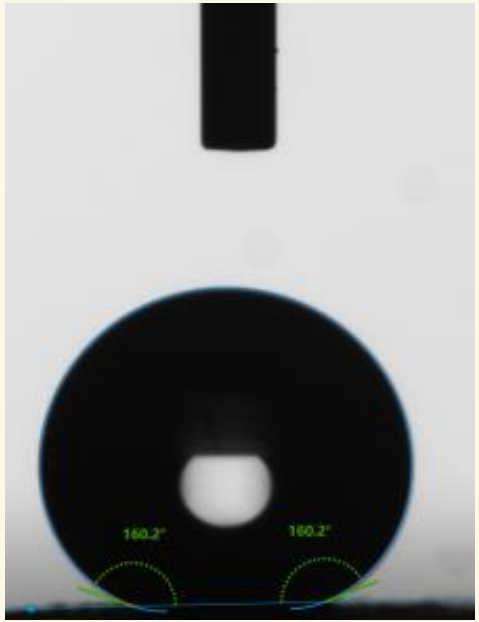
Completed work and basic experimental conditions



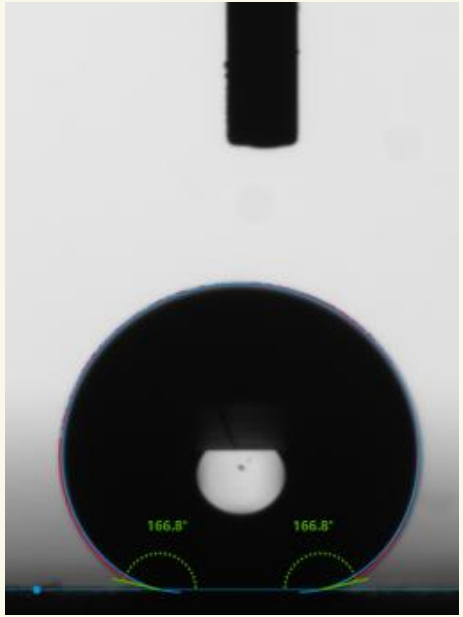


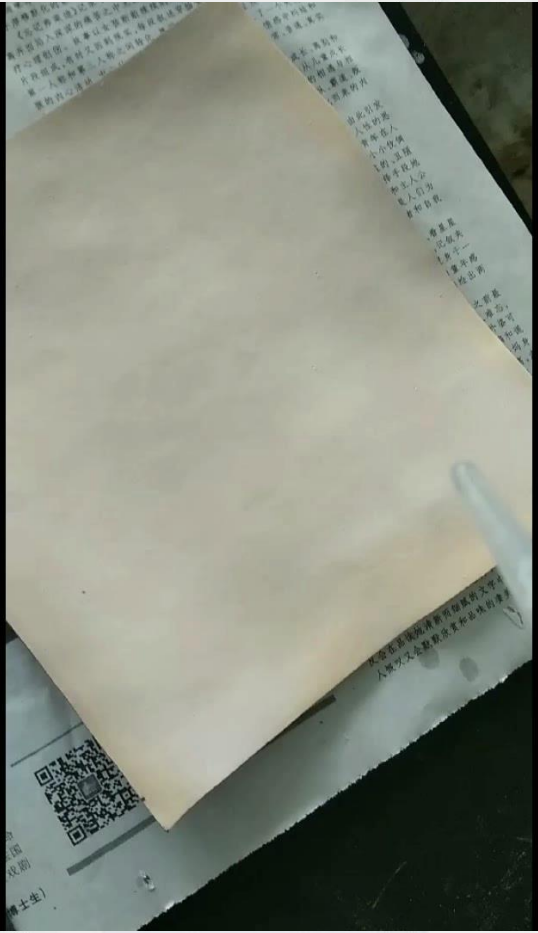
Characterization of coating properties---
determination of static contact angle of self-cleaning vegetable tanned leather

The static contact angle of self-cleaning frosted leather



The static contact angle of self-cleaning vegetable tanned leather

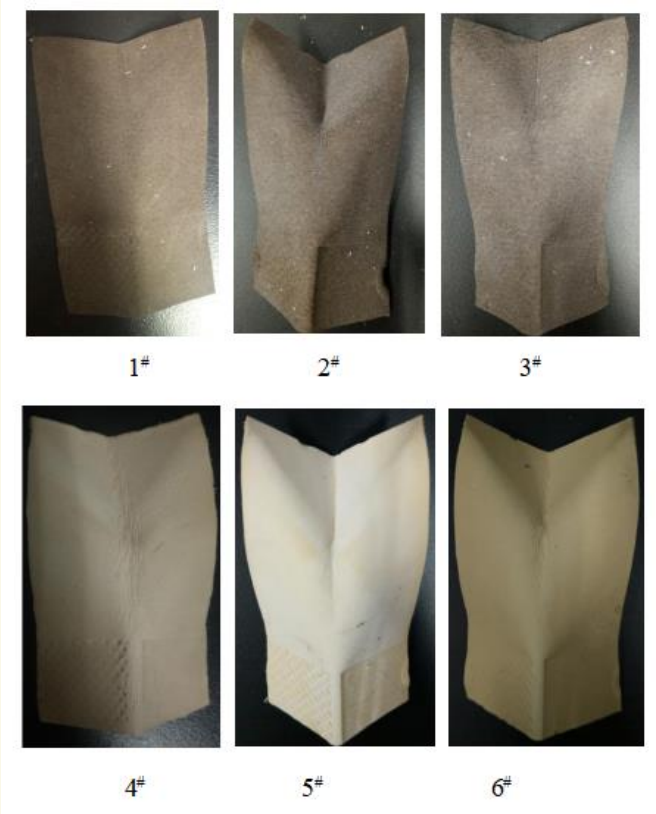




Determination of physical and mechanical properties of leather - Folding fastness

Fold fastness test

1# Uncoated frosted leather
2# Self cleaning wipe coated frosted leather
3# Self cleaning spraying coated frosted leather
4# Uncoated vegetable tanned leather
5# Self cleaning wipe coated vegetable tanned leather
6#: Self cleaning spraying coated vegetable tanned



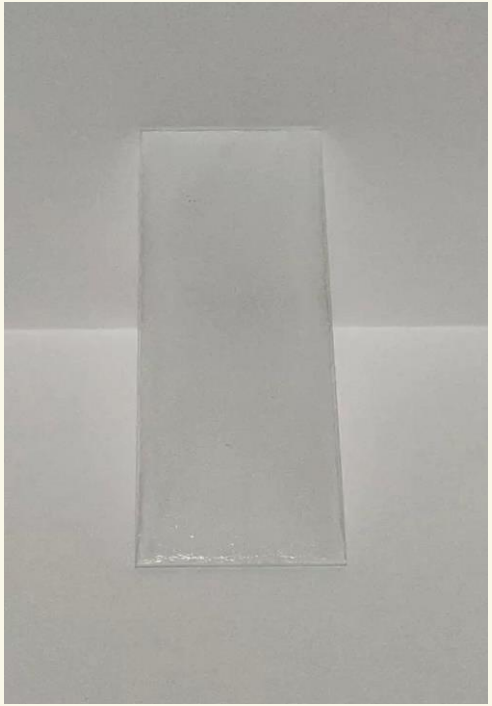
Determination of physical and mechanical properties of leather - <u>moisture permeability</u>

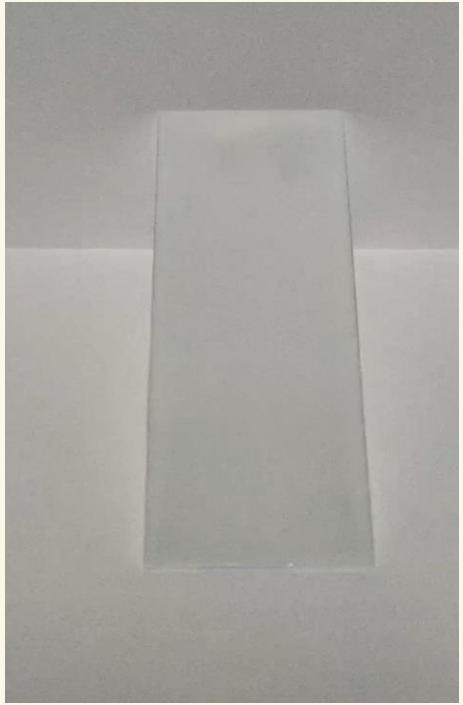
$$P = \frac{76.39 \times m}{d^2 \times t}$$

1#：P=0.3027， 2#：P=0.2936， 3#：P=0.3535
4#：P=0.1927， 5#：P=0.0511， 6#：P=0.0651

- **After self-cleaning coating, the water vapor permeability of leather samples has been influenced.**
- **Like air permeability, the water vapor permeability of frosted leather is generally stronger than that of vegetable tanned leather.**

Prospect:





- The self-cleaning anti graffiti effect has been realized on the glass substrate.
- This technology is intended to be used for leather substrate in the future.

Brief introduction of research group

Acknowledgement:

- Shandong Provincial Key Research and development program
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