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Self-cleaning glass with superhydrophobic coating

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NANYANG TECHNOLOGICAL UNIVERSITY

URECA
Undergraduate Research Experience on CAmpus

Category: 2
School of Materials Science and Engineering
Student: Wu Yuanyuan
Project ID: MSE12056

Self-cleaning glass with superhydrophobic coating

Our interest

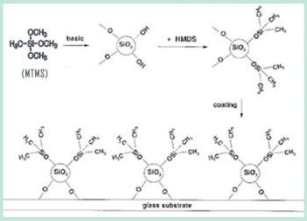
Skylights, sloped glazing, windows on high building: these are hard to access areas for cleaning. Our goal is to develop self cleaning glass!

Methodology

Make glass coating superhydrophobic by grafting hydrophobic groups on the surface.
(Superhydrophobic surfaces are extremely difficult to wet, with contact angle lager than 150°. This is also known as lotus effect.)

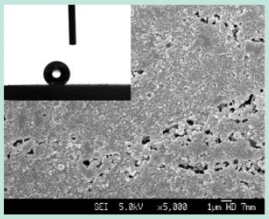
1. Experiment

a. Modificaiton of SiO_2 nanoparticles with HDMS
b. Mixing different ratios of modified SiO_2 nanoparticles to MTMS coatings.

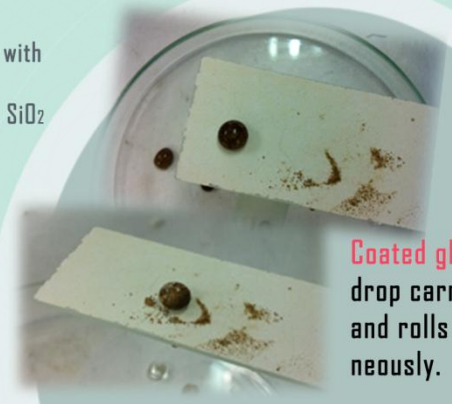


2. Results and analysis

2.1 Surface morphology



SEM image of superhydrophobic coating we developed. Inserted image is the corresponding water droplet image with contact angle 151°. (Water drop size: 4μL)



Coated glass: water drop carries the dust and rolls away spontaneously.

Normal glass: water drop sticks on the glass with the dust.

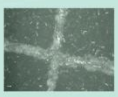
2. 2 Effect of curing temperature

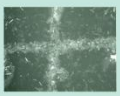
After trying 100°C, 200°C and 300°C, it was found 200°C gives best result as at 100°C reaction is not thorough, but at 300 °C, the hydrophbic groups (-CH3) is destroyed.

2.3 Mechanical properties of the coating

- Hardness test
3 samples with silica ratio pf 1:2:3 show pencil hardness of 5H, 6H, 6H respectively.

- Adhesion test
The more silica, the more adhesive the coating is on the glass.


1 SiO_2, 2% coating stripped


2 SiO_2, 5% coating stripped


3 SiO_2, 40% coating stripped

3. Conclusion & vision

Superhydrophobic coating can be achieved by certain reactants choice, ratio, temperature etc. However, hardness and adhesion are also important for commercializing the coating. We have approched the matching of experimental results and our goal now. Future research will focus on how to achieve large hardness and adhesivity while mainting large contact angle!

Project Title: Multifunctional Coatings by Incorporating Functional Nano-fillers
Supervisor: A/P Chen Zhong **Co-supervisor: Ms Wu Xin Hua**