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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 larger than 150°. This is also known as lotus effect.)

1. Experiment
   a. Modification of SiO₂ nanoparticles with HDMS
   b. Mixing different ratios of modified SiO₂ 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 150°. (Water drop size: 4µL)

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 approached the matching of experimental results and our goal now. Future research will focus on how to achieve large hardness and adhesivity while maintaining large contact angle!

2.1 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 hydrophobic groups (-CH₃) is destroyed.

2.3 Mechanical properties of the coating
- Hardness test
  3 samples with silica ratio of 1:2:3 show pencil hardness of 5H, 6H, 8H respectively.
- Adhesion test
  The more silica, the more adhesive the coating is on the glass.

1) SiO₂, 2% coating stripped
2) SiO₂, 5% coating stripped
3) SiO₂, 10% coating stripped

Project Title: Multifunctional Coatings by Incorporating Functional Nano-filler
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Co-supervisor: Ms Wu Xin Hua

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