Stable superhydrophobic surface based on silicone combustion product

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Introduction

➢ Up to now, many methods of preparing artificial superhydrophobic surfaces have been developed. However, not only most of the methods were demanded special equipments and expensive materials, but the created superhydrophobic surfaces were also lack of mechanical durability, which hindered their use in practical applications.

➢ With increasing amount of consumed silicone elastomer products, it is an important aspect that how to sufficiently reuse discarded silicone elastomer products.

➢ Herein, we report a kind of superhydrophobic powder with microstructures which can be obtained by simply burning silicone and then pulverizing. By a single step of hot-pressing, the powder can be utilized to prepare superhydrophobic powder/polymer composite surface with high water contact angle (WCA) and low sliding angle (SA), possessing excellent mechanical durability that can retain superhydrophobicity after 50 cycles abrasion tests.

Experimental

☐ Cured silicone was cut into small pieces and held in the flame of alcohol lamp in the air until the silicone pieces were completely burned. Smash the silicone combustion into powder.

☐ Powder was distributed on the bottom of a disc mold, then put in polypropylene (PP) disc piece and the mold was pressed under a pressure of 10 MPa for 30min at 180°C, as shown in Fig. 1.

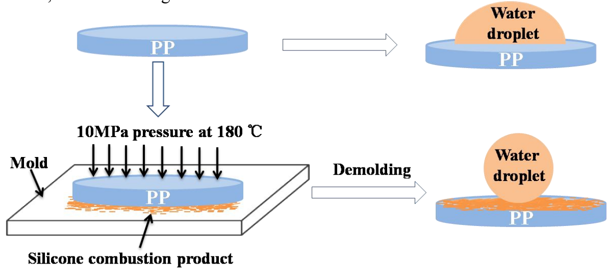

Fig. 1. Schematic of the preparation of superhydrophobic surface based on silicone combustion product using hot-pressing method.

Conclusion

✓ An easy-to-obtain water-repellent silica material was made from silicone elastomer combustion.

✓ Utilizing the powder, a superhydrophobic powder/polymer surface can be fabricated by a simple step of hot-pressing. The composite surface possessed excellent mechanical durability that can retain superhydrophobicity after 50 cycles abrasion test.

✓ This study has provided a new approach to reuse discarded silicone products to fabricate non-wetting surface. It is expected that the non-wetting silicone combustion product can be applied in more fields for practical use.

Results and discussion

1. Silicone combustion product

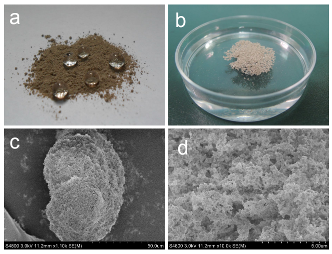

Fig. 2. Optical images of (a) water droplets on the surface of the silicone combustion product powder and (b) the powder floats on water; FESEM images of the powder at (c) low and (d) high magnifications.

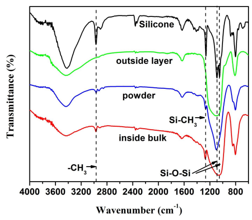

Fig. 3. FT-IR spectra of silicone, the outside layer, inside bulk and pulverized powder of the silicone combustion product.

2. Superhydrophobicity and morphology of the composite surface

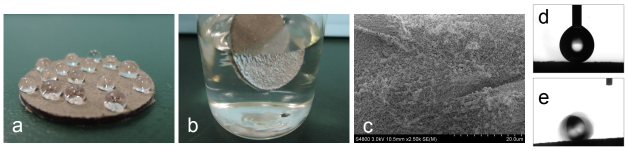

Fig. 4. (c) FESEM images of the superhydrophobic surface; optical images of (a) water droplets on the composite surface, (b) mirror-like phenomenon, (d) water contact angle of 164±2° and (e) sliding angle (4°) of the surface.

3. Influence of infiltration time to composite surface

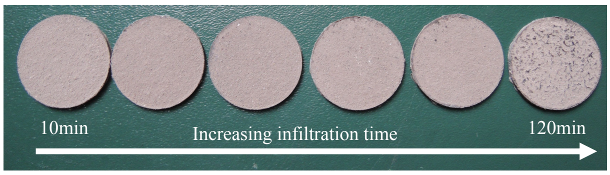

Fig. 5. optical images of silicone combustion product/PP composite surface with different infiltration times from 10 min to 120 min.

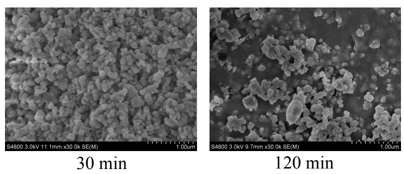

Fig. 6. FESEM images of silicone combustion product/PP composite surface with different infiltration times .

4. Abrasion test

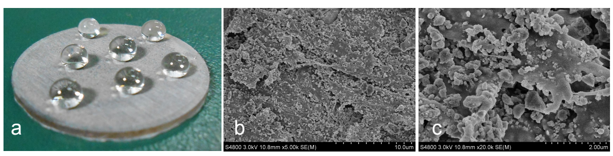

Fig. 7. (a) water droplets on the silicone combustion product/PP composite surface after 40 cycles sandpaper abrasion; FESEM images of the superhydrophobic surface after 40 cycles sandpaper abrasion at (b) low and (d) high magnifications.