Supporting Information

Superhydrophobic SiC/CNTs Coatings with Photothermal Deicing and Passive Anti-icing Properties

Guo Jiang*, Liang Chen, Shuidong Zhang, Hanxiong Huang

School of Mechanical and Automotive Engineering, South China University of Technology, Wushan Road 381, Guangzhou, 510640, P.R. China

8 Pages

4 Figures

2 Videos

The schematic of the ice adhesion testing device is shown in Figure S1. The hydrophobically treated glass column has a less than 1 mm wall thickness. The height between the flexible rope and the surface of the coating was 10 mm and the distance between the sensor and the glass column was 50 mm. We strictly controlled the testing device set-up prior to each measurement.

To characterize the effect of TEOS on adhesion of coatings, we prepared three coatings with the same SiC/CNTs ratio (2:1). One coating was unaltered, FAS-17 alone was mixed into one coating, and both FAS-17 and TEOS were mixed into the third coating. Water flow impact was tested and results are shown in Figures S2 and S3. Figure S2 shows that the SiC/CNTs coating is not hydrophobic, allowing complete wetting of the surface under water flow, and much damage to the coating. The SiC/CNTs-FAS-17 coating is hydrophobic due to the addition of FAS-17. However, the water flow cause some wetting of the coating surface, and began to destroy the hydrophobicity of the surface. The SiC/CNTs-TEOS/FAS-17 coating retains its superhydrophobic property under the water flow. The water flow could not wet the surface or damage the surface structure. This demonstrates that the partial hydrolyzing effect of TEOS provides improved bonding between the coating and EVA substrate.

The ice adhesion strength after ice/de-icing cycles on the surface of SiC/CNTs 2-1 coating was measured, shown in Figure S4. Ice adhesion strength increased slightly after ice/de-icing cycles, but in all cases was lower than that of the bare EVA surface. This illustrates that the coatings had effective icing/deicing properties. However, the adhesion strength measurement technique easily damaged the mico-nano structure. In our tests, the preferred deicing method was to utilize the photothermal properties of CNTs which preserved the mico-nano structure on the surface.

Figures and Videos in Supporting Information

Figure S1 Schematic for ice adhesion testing device

Figure S2 Water flow experiments of SiC/CNTs-TEOS/FAS-17, SiC/CNTs-FAS-17 and SiC/CNTs coatings

Figure S3 Samples before and after water flow

Figure S4 Ice adhesion strength of SiC/CNTs 2-1 coating after ice/de-icing cycles

Video S1 The entire deicing process of spherical ice droplet under the irradiation of NIR

Video S2 The deicing process of a 3 mm ice layer on the SiC/CNTs 2-1 coating surface when continuously irradiated by NIR (808 nm, 1W)

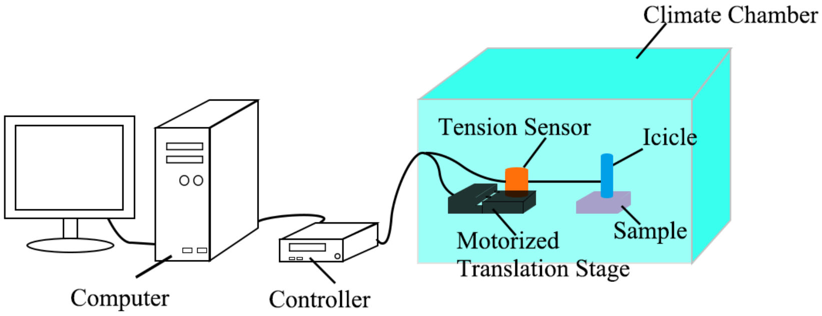

Figure S1. Schematic for ice adhesion testing device

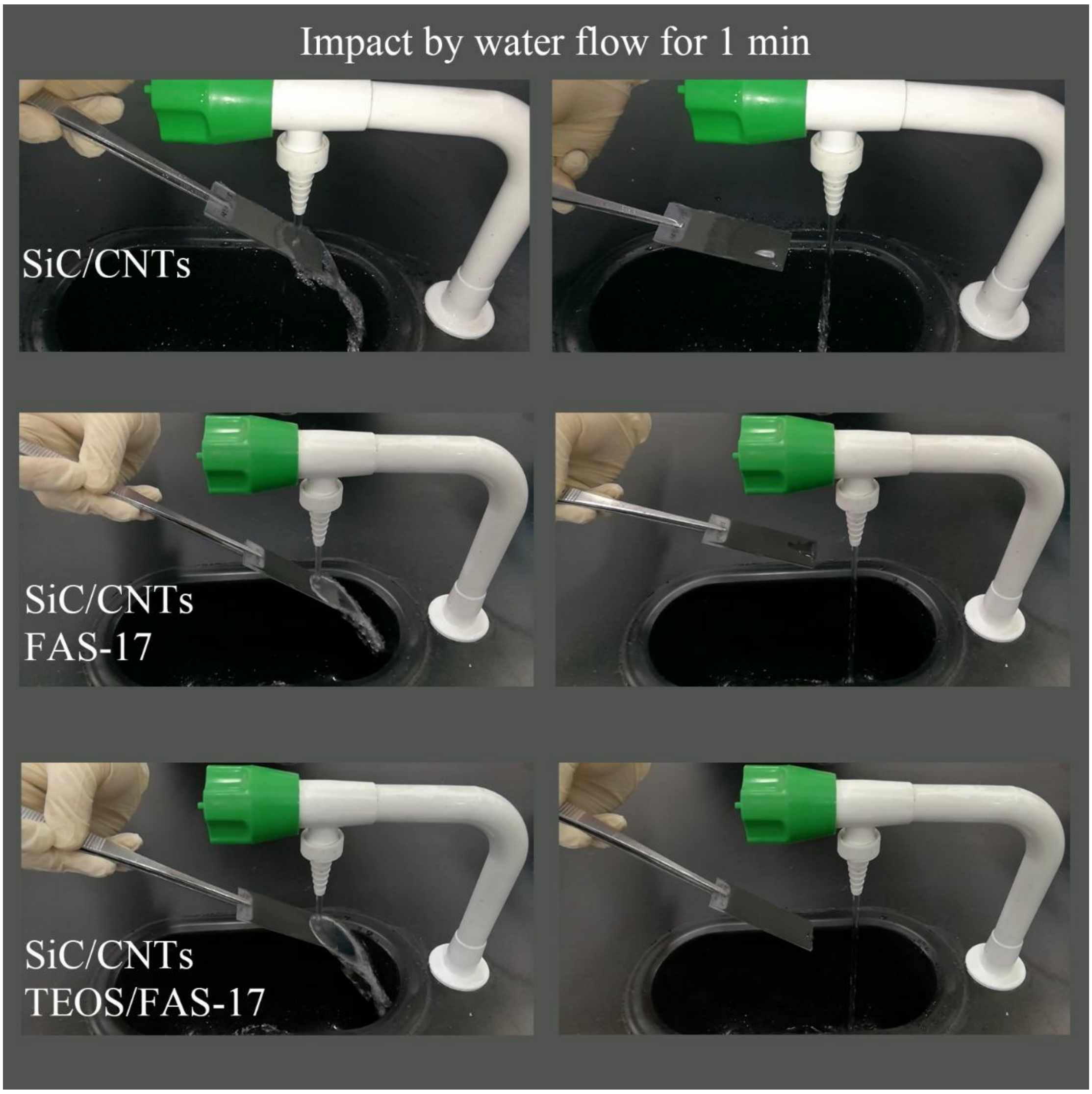

Figure S2. Water flow experiments of SiC/CNTs-TEOS/FAS-17, SiC/CNTs-FAS-17 and SiC/CNTs coatings

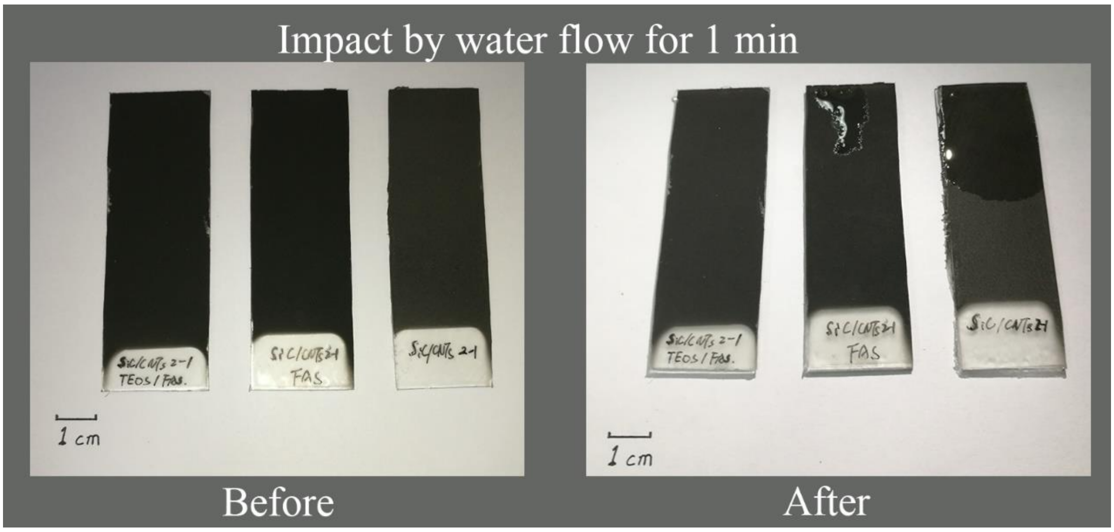

Figure S3. Samples before and after water flow

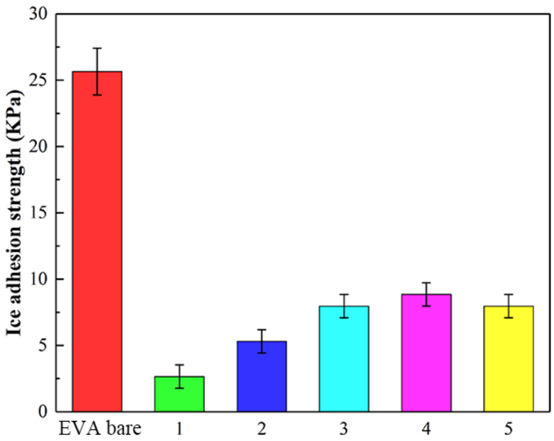

Figure S4. Ice adhesion strength of SiC/CNTs 2-1 coating after ice/de-icing cycles