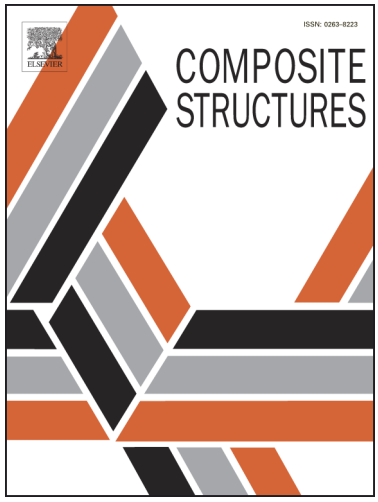

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A Novel Thermo-mechanical Anti-icing/De-icing System Using Bi-stable Laminate Composite Structures with Superhydrophobic Surface

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Abstract : A novel anti-icing/de-icing system composed of bi-stable laminate composite structures with superhydrophobic surface and soft electrothermal patch is investigated in this paper. In this system, the superhydrophobic surface has superior performance in anti-icing and de-icing by reducing the adhesion of the ice-skin interface; meanwhile, a thermo-mechanical way to remove ice is conducted by deforming the bi-stable structures using heating actuation method. The superhydrophobic layer is fabricated by decreasing the free energy of copper oxide on the copper surface. The water contact angle of the superhydrophobic surface is tested by an optical contact angle measuring device, which reaches above 155^{o} and the sliding angle is less than 10^{o}. In addition, the microstructure of superhydrophobic layer is characterized by using a scanning electron microscope (SEM) to illustrate the superhydrophobic mechanism. Moreover, outstanding self-cleaning properties and UV-durability are obtained on the prepared surface. Experimental results indicate that the system has good performances in both anti-icing and de-icing processes when working at the subzero temperature. Meanwhile, there is no liquid water left on the surface after the snap-through process of bi-stable structures. Besides, the factors that affect the anti-icing and de-icing performance of system are discussed, including the superhydrophobic property, morphing characteristic of bi-stable laminate composite