

Centrifuge Testing to Determine the Effect of Temperature on the Adhesion Strength of Ice

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Abstract : The adhesion of glaze ice on power infrastructure, ships and aerofoils cause monetary and structural damage. Here we investigate the influence of temperature as an important parameter affecting adhesion strength of ice. Two terms are defined to investigate this: 'freezing temperature', the temperature at which glaze ice forms; and 'ambient temperature', the temperature of the surrounding during the test. Using three metal surfaces, the adhesion strength of ice has been calculated as a value of shear stress at the point of detachment on a spinning centrifuge. Findings show that the ambient temperature has a greater influence than the freezing temperature on the adhesion strength of ice. This is because there exists an amorphous liquid-like layer at the ice-surface interface, whose bond with the surface increases in strength at lower ambient temperatures when the substrate conducts heat much faster than the ice and acts as a heat sink. The results will help us to measure the actual adhesion strength of ice to metal surfaces based on data from weather monitoring devices. Future tests envisaged focus on thermally non-conducting substrates and their influence on adhesion strength.

Keywords : ice adhesion, centrifuge, glaze ice, freezing temperature, ambient temperature

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