Physics & Astrophysics Colloquium

Fundamental Adhesion Studies on PDMS-based Coatings for Anti-icing Applications

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4:00 PM Friday, December 2, 2022, Room 211, Witmer Hall

Abstract:

The Ice accretion continues to be an ongoing threat for the performance of infrastructure or vehicles that work under conditions where ice is naturally formed. One possible approach to overcome ice accretion is the use of protective coatings that have low affinity to ice (anti-icing properties). Among the reported anti-icing coatings, PDMS coatings are still considered promising candidates for anti-icing applications though one of the challenges is the lack of availability of trustworthy materials and interfacial properties. In this study, we aimed to provide robust data on the adhesion properties of several commonly used PDMS systems, including commercial PDMS and our own formulated PDMS made in house. Glass and ice adhesion tests were performed using two different techniques: a microscale technique by a JKR device and a macroscale shear testing technique using a universal testing machine. To the best of our knowledge, a JKR device to measure ice adhesion properties is introduced for the first time. The energy release rates (G) and Young`s modulus (E) of the polymer coatings were measured at different temperatures and rates. Both techniques provided glass adhesion and ice adhesion values with certain similarities and differences. Results showed that adhesion depends not only on the surface chemistry of the samples but also on their mechanical properties. The overall results suggested that our formulated PDMS exhibited lower ice adhesion in comparison with those of the commercial samples.

Refreshments at 3:30 PM in Witmer Hall, Room 215

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