

A Lightweight, Low Power consumption De-Icing System for composite aircrafts using Macro Fiber Composites

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As aircraft configurations continue to advance there is a growing need for light weight, low power, retrofittable systems that can both detect and mitigate ice buildup on aircraft leading edges.

During the past years Smart Material Corp. has worked primarily with General Atomics Aeronautical Systems to develop a new type of PZT based De-Icing system for aircraft specifically those with composite leading edges. The goal for this program has been to develop a light weight, low power, retrofittable system that relies on a host structure's natural impedance and vibratory harmonics to both detect and then safely remove ice.

While existing De-Icing systems rely on either heat or large, potentially damaging, expulsive forces the PZT based "Smart Skin" does not require heat nor does it induce stress into the composite which would exceed the design limits of that composite. This has been achieved by integrating Smart Material's Macro Fiber Composites (MFCs) into the composite laminate.

Due to their excellent properties like flexibility, anisotropy and long term stability the Macro Fiber Composites fit most of the requirements to meet the specifications of a solid state De-Icing system based on the piezo electric effect.

This presentation investigates various De-Icing systems and compares the weight and efficacy of these systems to the "Smart Skin" MFC De-Icing System. The general characteristics of ice conditions are briefly discussed and are then followed by an overview of the proposed MFC-De-Icing system. Finally, first ice-tunnel test results are presented as well as a brief overview of expected next steps for continued development.