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# Wetting, de-icing and anti-icing behavior of roll-to-toll structured and plasma coated PU-films

Georg Umlauf, Jakob Barz, Joachim Mayer, Jan Hinnerk Henze, Christian Oehr

Fraunhofer IGB, Stuttgart, Germany

georg.umlauf@igb.fraunhofer.de

Ice formation on surfaces affects the functionality of means of transport, e.g. the wings of airplanes, or technical installations, such as rotor blades of wind turbines, and reduces their safety. This project in particular is researching a new approach to passive de-icing in flight operations of small and medium-weight helicopters. In addition to extending the operational availability (e.g. mountain rescue in winter or in bad weather), an active contribution to $CO_2$ and $NO_x$ savings is being made within the framework of environmentally friendly aviation. Furthermore, the safety of passengers, crews and third parties in aviation can be increased.
The passive de-icing system consists of microstructured, ice-repellent, self-adhesive PU films. These super-hydrophobic surfaces, with microstructure diameters of 35 µm or more, reduce wetting by water and at the same time reduce or delay ice formation. In addition, these films exhibit low ice adhesion. The innovative approach is to combine a hot stamping roll-to-roll process to create different surface structures with plasma enhanced chemical vapor deposition (PECVD) for a coating. The layers consist of hydrophobic plasma polymers, mainly fluorocarbon (CF) precursors or hexamethyldisiloxane (HMDSO) are used as precursors.
The basics of the investigations focus on ice formation and ice adhesion on the functionalized films. Different chemical compositions of the deposited plasma coatings in combination with different structures are investigated for their anti-ice effect and the manufacturing process is optimized. The aim is to achieve the lowest possible wetting with water by hydrophobic surfaces in advance. If ice freezes out on the surfaces, the ice adhesion force for removing the ice must be as low as possible in order to achieve effective de-icing. The anti-ice foils can be applied flexibly on particularly relevant surfaces on the helicopter (skid landing gear, tail boom, Fenestron tail rotor) or on other surfaces susceptible to ice (e.g. ski lifts).

**Keywords**
PECVD
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