

ROTOR

Ice Protection Systems

Rotors and Propellers

LDI Rotor blade Ice Protection Systems are built in a much simpler, thinner, and more robust way in comparison to conventional systems. The systems may be laid out so there is no temperature sensing necessary on the blade which additionally reduces complexity and failure rate



LDI Rotor blade Ice Protection Systems may be fully integrated in the composite structure for improved aerodynamics and light weight

The power consumption of the LDI system is considerable lower compared to state of the art rotor heating systems (Electro-thermal Graphite Heaters behind 0.04" thick stainless steel versus Villinger heat-able coating).

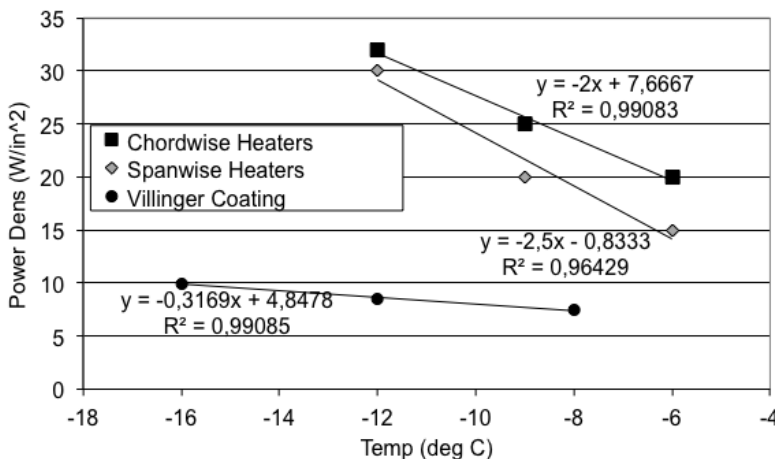


Fig. 1: Power consumption of LDI system Villinger's coatings compared to state of the art heaters

Full size helicopter rotor blade tests have been performed in the vertical climatic wind tunnel of the Penn State University and have shown superior performance.



Fig. 2: Full size rotor blade mounted for anti/de-icing testing in the AERTS facility at the Penn state University in State College

Efficiency

Heat-able coatings have low power consumption

The power consumption of the heat-able coatings is considerable lower compared to state of the art propeller heating systems (Electro-thermal Graphite Heaters behind 0.04" thick stainless steel versus Villinger heat-able coating).

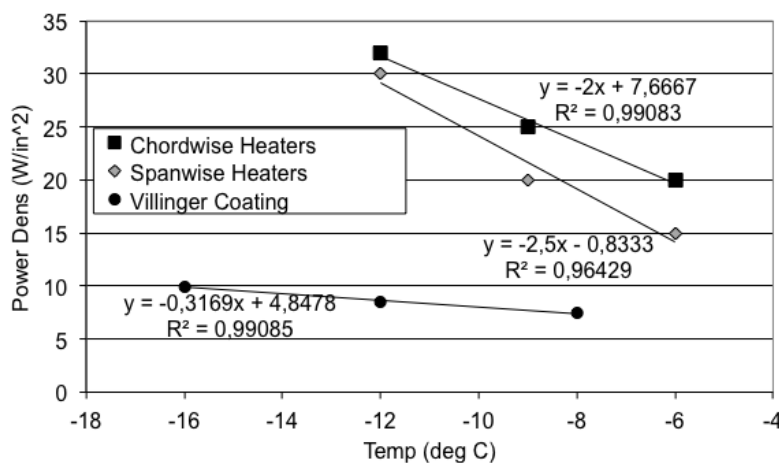


Fig. 3: Power consumption of heat-able coatings compared to state of the art heaters

Heat-able coatings have already tested in environmental spin rig testing and have shown superior performance

Some initial preliminary full size helicopter rotor blade tests have already been performed in the vertical climatic wind tunnel of the Penn State University.



Fig. 4: Full size rotor blade mounted for anti/de-icing testing in the AERTS facility at the Penn state University in State College



Fig. 5: Ice covered rotor blade in the AERTS facility

Fig. 6 & 7 (below): Rotorblade after de-icing is turned on: clean airfoil, minimal runback ice is remaining after only 20- 40 seconds heating



Villinger

Test Results

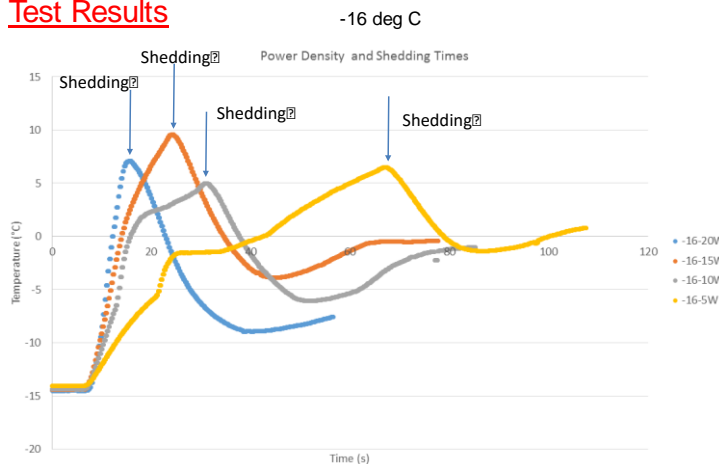


Fig. 8: The shedding of the ice on the rotor blade occurs at around 20 – 40 sec after turn on depending on the power density used.