

Experimental Study of Particle Deposition on Leading Edge of Turbine Blade

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Abstract : Breathing in foreign objects during the operation of the aircraft engine, impurities in the aircraft fuel and products of incomplete combustion can produce deposits on the surface of the turbine blades. These deposits reduce not only the turbine's operating efficiency but also the life of the turbine blades. Based on the small open wind tunnel, the simulation of deposits on the leading edge of the turbine has been carried out in this work. The effect of film cooling on particulate deposition was investigated. Based on the analysis, the adhesive mechanism for the molten pollutants' reaching to the turbine surface was simulated by matching the Stokes number, TSP (a dimensionless number characterizing particle phase transition) and Biot number of the test facility and that of the real engine. The thickness distribution and growth trend of the deposits have been observed by high power microscope and infrared camera under different temperature of the main flow, the solidification temperature of the particulate objects, and the blowing ratio. The experimental results from the leading edge particulate deposition demonstrate that the thickness of the deposition increases with time until a quasi-stable thickness is reached, showing a striking effect of the blowing ratio on the deposition. Under different blowing ratios, there exists a large difference in the thickness distribution of the deposition, and the deposition is minimal at the specific blow ratio. In addition, the temperature of main flow and the solidification temperature of the particulate have a great influence on the deposition.

Keywords : deposition, experiment, film cooling, leading edge, paraffin particles

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