

Variable Porosity Gauzes for Axial Compressor Testing

The performance of an embedded compressor stage is dependent on the shape of the stagnation pressure profile at its inlet. This profile is normally built up over the many stages of the compressor spool. However experimental research is often performed on single stage rigs as they are simpler to run and can save on costs. In this paper gauzes with spanwise varying porosity are used to tailor the stagnation pressure distribution at inlet to a single stage rig to simulate its performance in the embedded multi-stage environment.

The paper is presented in two parts: In the first part the methods for designing variable porosity gauzes are presented. Both 1D correlations and 3D CFD are used to design the size of the passages in the gauze. The gauzes are 3D printed in plastic and the designs are validated by traversing the flow at exit of the gauze.

In the second part the performance of the compressor with an embedded stagnation pressure profile is examined. Gauzes of different endwall boundary layer thicknesses are designed to test the robustness of the stage's operation with different levels of blockage. The comparison is also made to the performance of the stage in the case of a clean inlet flow without a gauze. The sensitivity of the stage to inlet profile is extreme, it is concluded that in the future single stage tests should be conducted with this kind of flow conditioning if representative conditions are to be achieved.