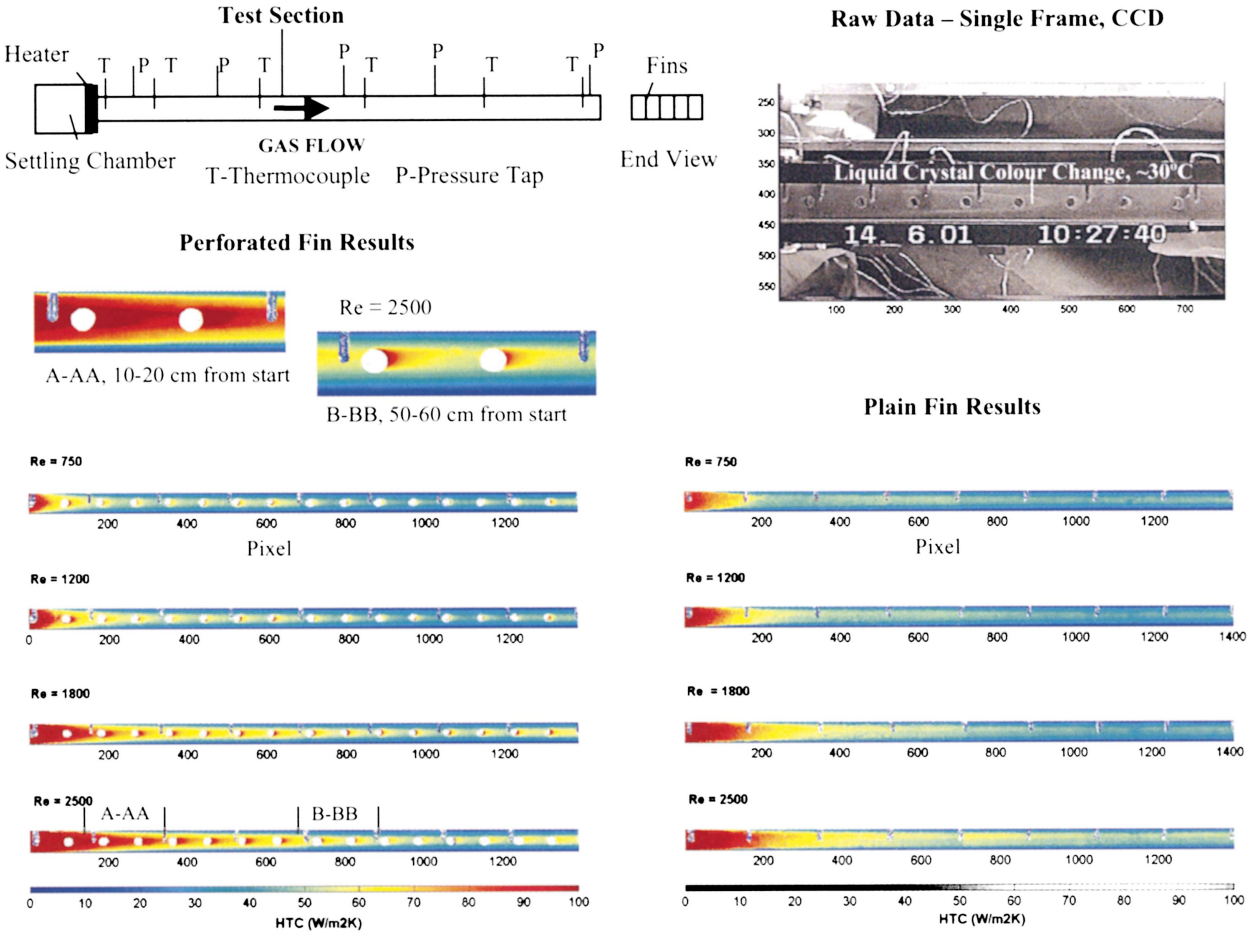

Photographs on the Effect of Perforations on the Heat Transfer due to Laminar Flow over an Extended Surface

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ABSTRACT

In the past it has not been resolved as to whether perforated surfaces on a fin enhance heat transfer. In this photographic study which utilizes liquid crystal thermography, the evidence suggests that there is an increase in the local heat transfer coefficient in the vicinity of the downstream side of the perforations. The perforations appear to partially disrupt the thermal boundary layer and they appear to allow a partial restart of the boundary layer on the backside of the hole. For these series of photographs, a transient heating technique is employed. Helium at approximately 70°C is allowed to flow through 5 perspex channels separated by 1 mm thick perforated fins. The channel cross sectional areas are 33 mm high by 13.1 mm wide. The channel length is 1 m. The initial temperature of the channels was 24°C. A one degree, narrow band, liquid crystal (30°C colour change temperature) was painted over the black painted centre channel fin. The time history of the colour change of the painted fin was recorded on a standard CCD video camera. The peak intensity-time relationships were obtained from image processing the recorded video and the heat transfer coefficients were evaluated using a transient thin fin heat transfer model. The helium temperature was measured at 5 locations along the channel. As can be seen, there appears to be a local heat transfer enhancement near the backside of the perforations. Comparisons are made to non-perforated fins in the channel Reynolds number range of 750-2500.