Effects of Mach Number, Reynolds Number, and Jet Spacing on Surface Heat Transfer for a Full Array of Impinging Jets

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Presented are data which illustrate the effects of Mach number, Reynolds number, and hole spacing on surface Nusselt numbers produced by an array of jets impinging on a flat plate. Considered are Reynolds numbers ranging from 17,300 to 60,000 and Mach numbers from 0.1 to 0.45. Impingement hole spacings are 5*D*, 8*D*, and 12*D* in the streamwise and spanwise directions. Local spatially-resolved and spatially-averaged Nusselt numbers show strong dependence on the impingement jet Reynolds number for each situation as the jet Mach number is maintained constant. Nusselt numbers show negligible variations between *Ma*=0.1 and 0.2, however, data taken at Mach numbers greater than 0.2 (as the Reynolds number is held constant) show that Mach number has a significant impact on local and spatially-averaged Nusselt numbers. This Mach number dependence changes with hole spacing, with greater Nusselt number increases with the less dense impingement arrays. These variations are described using new correlations, which account for the effects of Mach number for all three impingement hole spacings.

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