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Turbulence in soft-walled micro-channels[1] S.S. SRINIVAS, V. KUMARAN, Indian Institute of Science, Bangalore 560 012, India. — Transition to turbulence in soft-walled microchannels channels occurs at a much lower Reynolds number (Re) than that when the walls are rigid. To gain insights into the transition, we have studied the fluid flow in these channels using Particle Imaging Velocimetry, along the streamwise and wall-normal directions. The dimensions of the microchannels studied are approximately 4 cm $\times$ 160 μm $\times$ 1.5 mm. We see qualitative agreement between experiments and simulations, considering channel deformation, for laminar flows. Significant departure from the laminar flow profile is seen after transition. The root mean square of velocity fluctuations along streamwise and wall-normal directions is unsymmetric and is non-zero at the wall. This gives rise to non-zero Reynolds stress at the surface, indicating the coupling between soft surface and the fluid. The turbulence production term too is nonzero at the surface, as opposed to that for a rigid channel flow. This implies there is transfer of energy from the surface to the fluid. The scaled maximum of the velocity fluctuations and the Reynolds stress (divided by the fluid density) in the soft-walled microchannel for Re in the range 250-400 are comparable to those in a rigid channel at Re in the range 5000-20000.

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