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Investigation of the required length for fully developed pipe flow with drag-reducing polymer solutions YASAMAN FARSIANI, BRIAN ELBING, Oklahoma State University — Adding trace amounts of long chain polymers into a liquid flow is known to reduce skin friction drag by up to 80%. While polymer drag reduction (PDR) has been successfully implemented in internal flows, diffusion and degradation have limited its external flow applications. A weakness in many previous PDR studies is that there was no characterization of the polymer being injected into the turbulent boundary layer, which can be accomplished by testing a sample in a pressure-drop tube. An implicit assumption in polymer characterization is that the flow is fully developed at the differential pressure measurement. While available data in the literature shows that the entry length to achieve fully developed flow increases with polymeric solutions, it is unclear how long is required to achieve fully developed flow for non-Newtonian turbulent flows. In the present study, the pressure-drop is measured across a 1.05 meter length section of a 1.04 cm inner diameter pipe. Differential pressure is measured with a pressure transducer for different entry lengths, flow and polymer solution properties. This presentation will present preliminary data on the required entrance length as well as characterization of polymer solution an estimate of the mean molecular weight.

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