

The characteristics of convective heat transfer and fluid flow within a square cross-section serpentine channel are experimentally studied for two groups of polymeric viscoelastic fluids, shear-thinning and constant-viscosity Boger solutions. The elastic turbulence can be created by the non-linear interaction between elastic stresses generated within the flowing high-molecular-weight polymer solutions and the streamline curvature. In order to confirm elastic turbulence in this geometry, pressure drop across the serpentine channel was measured. The findings indicate that the measurements of non-dimensional pressure-drop increase approximately from 1.48 to 4.82 for viscoelastic solutions compared with the Newtonian fluid over a range of Weissenberg number from 4 to 211. The convective heat transfer enhances due to elastic turbulence by up to 200% for low polymer concentration (dilute) solutions and reaches up to 380% for higher polymer concentration (semi-dilute) solutions under creeping-flow conditions in comparison to that achieved by the equivalent Newtonian fluid flow at low Graetz number (up to 14.6). We propose a modified Weissenberg number which is able to approximately collapse the mean Nusselt number data for each solution group.