Dean flow dynamics of inelastic fluids in rectangular microchannels

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Mixing fluids and manipulating materials in the microfluidic system have been challenging topic due to laminar flow with limited convection. In case of curved channel, however, secondary Dean flow arisen by the inertial force is one of the solutions to enhance mixing and particle separation. In this study, the Dean flow dynamics of inelastic fluids in rectangular microchannels is examined numerically, involving Non-Newtonian properties based on the coupled equations of Cauchy momentum with the constitutive model of Bird-Carreau fluids. Effects of rheological properties on the Dean flow dynamics are investigated with variations of the Dean number. The axial velocity profile is changed from inward skewness to outward skewness showing maximum inward skewness when moved to high Dean number. The secondary flow is also improved at the high Dean number in case of non-Newtonian fluid.