

Abstract

Microfluidic devices are used to manipulate fluids at microscale, with typical dimensions of the order of tens or hundreds of micrometers. Microfluidic flows are usually driven by pressure difference forcing (PDF), or electro-osmotic flow (EOF) forcing, with the latter method using electric fields to promote the flow. The current knowledge on the use of EOF technique is still limited especially with complex fluids. The goal here is to expand both our practical and fundamental knowledge on electrically-driven flows, by investigating EOF experimentally, using viscoelastic fluids in microscale flow configurations.

The first work presents two experimental methods to measure both the electro-osmotic and electrophoretic mobilities in a straight rectangular microchannel, using micron-sized tracer particles. The 1st method is based on imposing a pulsed electric field, while the 2nd is based on the use of a sinusoidal electric field. The second work investigates the conditions that promote the onset of electro-elastic instabilities in straight microchannels incorporating either hyperbolic shaped contractions followed by abrupt expansions, or with symmetrical hyperbolic shaped contractions/expansions.

Finally, a quick overview of a recent published work. it is also an experimental work aiming to characterize the rheological properties of the electrorheological (or magnetorheological) fluids under extensional flow using the Capillary Breakup Extensional Rheometer (CaBER), while an external electric (or magnetic) field is applied to the sample.