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A microfluidic study of the rheology, slippage and flow instabilites of wormlike micelles PHILIPPE NGHE, GUILLAUME DEGRE, PATRICK TABELING, MMN, UMR Gulliver ESPCI-CNRS 7083, ARMAND AJDARI, PCT, UMR Gulliver ESPCI-CNRS 7083, MMN, UMR GULLIVER ESPCI-CNRS 7083 TEAM, PCT, UMR GULLIVER ESPCI-CNRS 7083 TEAM — We characerize by Particle Image Velocimetry the Poiseuille flow semi-dilute solutions of wormlike micelles (a CTAB and sodium nitrate aqueous solution and a CpCl solution) in pressure resistant microchannels. Thanks to the high aspect ratio of our channels, we can measure the local rheology of the solution, independantly from the slippage at the wall, according to a method already validated on non-newtonian polymer solutions. As the pressure driving the flow is increased, the velocity profiles reveal first a newtonian phase, then apparition of a dramatically lower viscosity second phase at the walls, which is the so called shear banding regime. First we deduce the local rheology of the solution from these velocity profiles. This method gives access to the stress versus shear rate relation over a domain unexplored in classical Couette geometries, characterizing more than a decade of deformation rates for the high shear phase. Then we measure the slip length to be below 1.5 microns in these flows. Finally we study the development of an instability at the interface between the two phases, similarly to what has already been found in Couette like geometries.

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