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Shear banding fluids in microchannels: high shear rheology, slippage and Poiseuille flow instability PHILIPPE NGHE, GUILLAUME DEGRE, PATRICK TABELING, MMN, UMR CNRS-ESPCI 7083 Gulliver, ARMAND AJDARI, PCT, UMR CNRS-ESPCI 7083 Gulliver — We characterize by Particle Image Velocimetry the Poiseuille flow a semi-dilute solution of wormlike micelles (a CTAB and sodium nitrate aqueous solution) in pressure resistant microchannels. At low shear rates, we observe a parabolic profile. Increasing the pressure driving the flow, the fluid separates into two phases above a critical shear rate at the wall. This is the so called shear-banding regime. Deducing the non-linear rheology from the velocity profiles by a local calculation, we are able to measure the stress versus shear rate curve at least one order of magnitude above the dynamical range attainable in Couette geometries, independently from the slippage, revealing a strongly shear-thinning structure. In addition, by extrapolation of the velocity profiles to the wall position, we measure an absence of slippage at the wall. Looking into more details to the increase in velocity fluctuations in the downstream direction, we characterize a supercritical instability in this shear-banded Poiseuille flow, localized at the interface between the two phases with a wavelength comparable to the confining dimension.

Philippe Nghe
MMN, UMR CNRS-ESPCI 7083 Gulliver

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