Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

The flow of wormlike micelles in microchannels: a micro-PIV study of shear-banding, interfacial instabilites and tracers migration
PHILIPPE NGHE, MMN, UMR CNRS-ESPCI Gulliver 7083, GUILLAUME DEGRE, LOF - UMR CNRS-Rhodia 5258, PATRICK TABELING, MMN, UMR CNRS-ESPCI Gulliver 7083, ARMAND AJDARI, PCT, UMR CNRS-ESPCI Gulliver 7083 — We characerize 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. 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, in agreement with the macroscopic rheology obtained in Couette rheometers. Then we study the development of an instability at the interface between the two phases, with a wavevector in the vorticity direction and a wavelength corresponding to smallest dimension of the channel. Finally we discuss the hypothesis of passive tracers : depending on their size, we observe a tracer depletion in the high-shear phase, which may be to high normal forces.

Patrick Tabeling
MMN, UMR CNRS-ESPCI Gulliver 7083

Date submitted: 13 Dec 2007 Electronic form version 1.4