

Abstract Submitted
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Yielding transition of Carbopol gel in a vertical pipe¹ YANG LIU,
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DE BRUYN TEAM — We have investigated the yielding transition of a simple yield-
stress fluid (Carbopol 940) in a vertical pipe. The Carbopol gel was displaced by a
Newtonian liquid injected at a constant, controlled rate at the bottom of the pipe.
Rough- and smooth-walled pipes were used to study the effects of wall boundary con-
ditions. The pressure in the Carbopol was measured by a pressure gauge fixed on the
pipe wall, and the velocity profile in the Carbopol was measured by particle-image
velocimetry (PIV). When the Newtonian liquid was injected, the rate of pressure
increase was initially high, then decreased to a constant slow rate at later times. A
time t_c was defined by the intersection of straight lines fit to the pressure-time data
at early and late times. In the rough pipe, the wall shear stress at t_c is equal to
the yield stress, suggesting that this time corresponds to yielding of the fluid. The
velocity profiles were parabolic before yielding, and nearly a plug-like afterwards. In
the smooth pipe, the pressure and velocity profiles appeared to show similar behav-
ior to that in the rough pipe, but the wall shear stress at t_c is substantially smaller
than the yield stress and fluid motion was due to wall slip.

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