

Thixotropic Rheological Behavior of Athabasca Bitumen and Heavy Oil

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Hydrocarbon resources including bitumen and heavy oil have become essential sources of energy. Their flow properties during production, transport and refining have become key building blocks for decision makers in industry. Bitumen and heavy oil exhibit non-Newtonian rheological behaviors [Bazyleva et al., *J. Chem. Eng. Data* 2011, 56, 3242–3253; Bazyleva et al., *J. Chem. Eng. Data*, 2010, 55, 1389-1397; Fulem et al., *Fluid Phase Equilibria* 272, (2008), 32-41] particularly at lower temperatures. Thixotropy, the variation of apparent viscosity with time at fixed shear rate, is one such behavior. In the present work, thixotropic behaviors of Athabasca bitumen and Maya crude oil that lead to time and shear history dependent viscosities are explored systematically. The magnitudes of these effects are measured using a shear stress controlled Anton Paar rheometer. The results highlight the impact of prior shear history and the duration of a rest period prior to viscosity measurements on the reproducibility of values obtained and consequently the need for well-defined initial conditions for rheological measurements. The results will also act as benchmark data sets for validation of rheological models for bitumen and heavy oil that are immersing in the literature [M. Dion, MSc Thesis, University of Alberta, 2011; K. Dullaert, J. Mewis, *J. Non-Newton. Fluid Mech.*, 139 (2006) 21-30].