Heavy Oil and Bitumen Viscosity Measurement During Drilling Activities

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Heavy oil and oil sand reservoirs (HOOS) can naturally exhibit orders of magnitude variation in oil viscosity even at the 10 meter scale! To assess fluid property variation it is necessary to measure viscosity variations at high resolution from core, cuttings or downhole. For example in the Peace River oil sands area of Alberta , the dead oil viscosity may change from 10,000 cP (at 20°C) at the top of the oil column to greater than 1 McP at column base. Shale baffles and barriers may compartmentalize the reservoir. The viscosity data suggests cold production may be achieved in the upper part of the oil column while the deeper oil column requires thermal recovery; decisions on well placements and recovery process are made using the fluid mobility profiles.

Measured oil viscosity is a function of not only intrinsic oil properties (source) and in reservoir alteration, but also sample storage conditions and the duration of time from core collection to oil analysis (Adams et al, 2008). Volatilization of light ends during sample storage, handling, extraction and cleaning most significantly affect the measured viscosity of heavy oils and bitumen. Therefore oil viscosity should be measured on fresh samples as soon as possible after drilling.

Traditionally, oil is recovered from HOOS reservoir samples using centrifugation. We have developed a more effective recovery technology which uses remotely controlled compaction to squeeze oil out of core or cleaned cuttings samples. The mechanical extraction system (PlungerTM) compacts core in a closed pressurized cell to extract fluids in approximately 20-30 minutes. During the winter drilling program of 2009, the plunger was operated at several rig sites in W. Canada together with a viscometer to produce the first real time, accurate, onsite, viscosity profiles. Rapid decisions whether to perform fluid production testing can be made while the rig is in place and logging tools are being recovered. Using mobility contrasts the compaction device may also be used to recover insitu water samples.

Application of the device to insitu frozen core allows for determination of insitu “live oil” viscosities in HOOS reservoirs and emplacement of the device in downhole logging devices would herald an era of routine live oil viscosity logging in the ubiquitously heterogeneous HOOS reservoirs. We describe our progress towards real time insitu oil viscosity measurement in HOOS reservoirs.