Phase Behaviour & Properties of CO_2-Oil Systems Joint Industry Project (JIP)

CO_2 in EOR and 4D Seismic

The following two work packages relating to CO_2 storage are covered in the next phase of the "*Reservoir Fluids Studies 2012-2015 Programme*".

Work Package 1 – PVT, Phase Behaviour & Properties of CO_2-Oil Systems

CO_2 storage in depleted reservoirs and its application in Enhanced Oil/Gas Recovery are among techniques being suggested for reducing the emission of this greenhouse gas. The industry has a long experience with injection of CO_2 for EOR processes. However, the main source of CO_2 is now industrial plants (e.g. power plants, factories and chemical processes). These CO_2 sources and associated separation techniques have different impurities (e.g. N_2 CO and H_2). Heriot-Watt has an on going JIP research programme on the effect of these impurities on the phase behaviour and properties of CO_2-rich systems. The objective of the project is to conduct an integrated experimental and modelling investigation on the effect of CO_2 (and impurities) on the phase behaviour and properties (including but not limited to density, viscosity, IFT, asphaltene precipitation, MMP, MME, slim tube displacement, forward and backward contacts and swelling tests) of CO_2-oil systems, in particular heavy oils.

Work Package 2 - Speed of Sound Measurements & Prediction

Recent advances in generation and interpretation of seismic data provide additional information on hydrocarbon in place and frontal advancement in 4D application. An essential ingredient is reliable estimation of fluid response to seismic waves, that is, the in-situ fluid sound velocity. Heriot-Watt University have developed an apparatus to measure sound velocity, which will be transferred to one of the new Hg-free equipment (after increasing the temperature range to 150 °C). Sound velocity measurements could be conducted on the same batch of fluid along with direct measurements of fluid composition, density, viscosity and interfacial tension between the phases. It is proposed to use the above experimental and theoretical capabilities to:

(a) Measure and develop predictive models of sound velocity in gas-oil, particularly for (near) miscible conditions, and CO_2 systems as input data particularly in 4D seismic

(b) Measure wave characteristics and relate them to other fluid properties as a tool for non-contact method of fluid characterisation and property estimation

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