

PDO Nested Polymer Modelling workflow: The Use of Multi-Scale Models to Drive Decisions for a Mature Polymer Flood

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ABSTRACT

Due to the complex nature of the reservoir rock and fluid properties in Oman, Petroleum Development Oman (PDO) has commenced several Enhanced Oil Recovery (EOR) methods. One of the major projects is a full field polymer flood in one of the fields in the South of Oman. It is a mature project where phase 1 started in 2010 followed by phase 2 in 2015. The plan is to implement polymer flood in a wider spread across the field in Phase 3 which is in planning and preparation phase.

As part of the readiness requirements for Phase 3, a proper understanding of polymer flood performance in Phase 1&2 patterns and their history match (HM) improvement were required. This would support in gaining confidence on the robustness of forecast for Phase 3, in addition to making decisions on further optimizations. However, number of these requirements needed detailed modeling, while others could be done with larger size models. Thus, a Model Framing Event (MFE) was held where it was decided to go for the nested polymer modeling approach where different scale models were used depending on the information required to support certain decisions.

For instance, information on polymer adsorption, shear effect, in-situ rheology requires a fine detailed model to capture the physics nature of the polymer and its behavior in the porous media. Therefore, a fine scaled physics model with dimensions of 5x5x1 meters was built to capture such information. In addition, the physics model was also used to evaluate the impact of water alternating polymer (WAP) injection, reflecting interrupted polymer flood due to operational upsets on medium to long term polymer flood value.

A relatively larger segment models were built to understand the patterns performance and analyze them in terms of PV injected, WAP periods, Recovery Factors and others. This would help gain insights on opportunities to improve and optimize.

Finally, all data and information gathered from the different models were fed to the full field scale model to understand the full project potential. This paper explains how the models were used and information gained and decisions that could be driven from each.