TG22

Predicting Flow Performance of Tight Gas Reservoirs - Some Key Aspects

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SUMMARY

The ability to predict reliably the performance of oil and gas wells is key to the economics of all development projects. The methodology used in the industry relies heavily on the quality of the data gathered from exploration and appraisal wells, and on workflows which involve reservoir simulations. For the particular case of tight gas reservoirs, this process requires some specific precautions or methods. The presentation will describe some key aspects which are relevant for tight gas reservoirs.

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Special Core Analysis is required to obtain reliable petrophysical parameters. Absolute permeability of tight gas reservoirs is usually strongly influenced by the net confining stress, meaning that measurements must be conducted under stress under a loading representative of in situ reservoir conditions. Fig 1 shows the ratio of permeability under stress to the permeability under ambient conditions for 2 fields. Measurements on dry samples may also significantly overestimate the gas permeability at initial water saturation. In situ water saturation measurements by Dean & Stark extraction must be therefore planned on tight sands formations. Particular attention on harsh drying of shaly, tight sandstones is necessary to avoid an overestimation of true rock permeability which can range from 50 to 500% depending on initial permeability, clay type and amount.

Hydraulic fracturing is widely used to achieve production enhancement. Prediction of post frac performance is a complex task given that many parameters are required to describe fracture geometry and formation damage induced by fracturing fluids. The presentation will refer to lab experimentations which demonstrate that formation damage inside the reservoir is dominated by a relative permeability effect resulting from fracturing fluid leak off. Additional experimentations show that this water blocking effect cannot be removed unless a sufficient pressure drawdown is applied to the formation. Two phase flow simulations are required to model these phenomena.

The very high number of wells drilled in TGRs development lead to the creation of overcharged simulation models with numerous Local Grid Refinements (LGRs) required to describe properly hydraulic fractures. An implicit method based on the modification of transmissibilities between the cells containing fractures and neighboring cells has been developed and tested to avoid the difficulties linked to the explicit representation (with LGRs) of hydraulic fractures in dynamic models. The method incorporates corrections of the productivity index of the fractured wells as a function of matrix permeability, frac parameters and cell dimensions in the model.

Figure 1