DEVELOPMENT OF MATHEMATICAL MODELS OF PHYSICAL AND CHEMICAL PROCESSES IN OIL RESERVOIRS

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This report concerns with the actual problems in the field of mathematical modeling of physical and chemical processes in hydrocarbon deposits. Actuality of these problems is due to the current development of hydrocarbon exploration and production sector: unconventional oil resources become a substantial part of companies' activities. Dealing with such reserves implies the use of more sophisticated recovery technologies than standard oil fields waterflooding. In turn this makes more complicated those physical and chemical processes that control hydrocarbon recovery. In order to meet these challenges a subsequent development of corresponding mathematical models of in-situ processes is assumed.

In this report the state-of-the-art mathematical modeling techniques applied to hydrocarbon recovery from deposits are discussed and the substantial difficulties associated with the modeling of the most challenging recovery technologies are specified. Based on this analysis a list of priority tasks is formulated and discussed:

- development of a classical mathematical model (initial-boundary value problem) of non-isothermal multiphase multicomponent flow in a reservoir for the case of oil shales (assuming kerogen's thermal decomposition)
- development of micro-scale mathematical models of physical and chemical processes in hydrocarbon deposits (pore scale) and formulation of a reasonable techniques that link micro-scale and classical macro-scale mathematical models
- development of advanced modeling techniques that deal with substantial uncertainty of reservoir parameters and proper evaluation of the impact of this uncertainty
- integration of standard simulation techniques used for numerical modelling of hydrocarbon recovery and new methods of predictive modeling based on processing big data.

In this report particular results obtained in the course of solving the formulated tasks are briefly presented.

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