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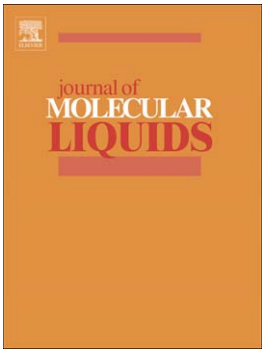

Novel method for estimation of gas /oil relative permeabilities

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PII: S0167-7322(16)30316-6
DOI: doi: 10.1016/j.molliq.2016.08.055
Reference: MOLLIQ 6216

To appear in: *Journal of Molecular Liquids*

Received date: 5 February 2016
Revised date: 14 June 2016
Accepted date: 16 August 2016

Please cite this article as: Mohamadi Mohamadi-Baghmolaei, Reza Azin, Zahra Sakhei, Rezvan Mohamadi-Baghmolaei, Shahriar Osfouri, Novel method for estimation of gas /oil relative permeabilities, *Journal of Molecular Liquids* (2016), doi: 10.1016/j.molliq.2016.08.055

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Novel Method for estimation of Gas /Oil relative Permeabilities

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Abstract

As the ages of most oil fields fall in the second half of their lives, many attempts have been made to enhance oil recovery in an efficient way. Gas injection into oil reservoirs for EOR purposes requires relative permeability as a crucial issue in reservoir engineering. In this study, a new method is applied to predict relative permeabilities of gas/oil system related to various rock and fluid types. For this reason, a soft computing technique- Multi-gene genetic programming (MGGP) is employed to develop tools for prediction of relative permeability. The new methods are evaluated by experimental data extracted from open literature and are validated by extensive error analysis. The generated smart mathematical equations are able to predict relative permeabilities of gas/oil system with high accuracy and are applicable for various types of rock and fluid as well. In contrary to other reported correlations, the new novel equations require oil API and gas molecular weight as extra input variables to improve their estimating ability for every type of rock and fluid. The proposed technique is promising and encouraging for petroleum and reservoir engineers to be implemented for other gas/oil petro-physical properties.

Keywords: Reservoir engineering, Relative permeability, Gas injection, Multi-gene genetic programming (MGGP), Empirical correlation

1. Introduction

Phenomena such as diffusion, dispersion, viscous fingering are more dominant in porous medium especially in presence of heterogeneities. These factors are the main reason for complexity of multiphase flow in porous media [1]. The significance of multiphase flow in porous media in Soil Science, Hydrology, Chemical Engineering and Petroleum Engineering vindicate the need of well understanding of this issue [2]. Multiphase flow is strongly essential in reservoir engineering in order to recognize productivity, injectivity, and ultimate recovery. The conventional ways of describing the fluid flow in porous medium are theoretical-empirical models such as Navier-Stokes, Darcy, Brinkman and Darcy-Forchheimer. The mentioned flow

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