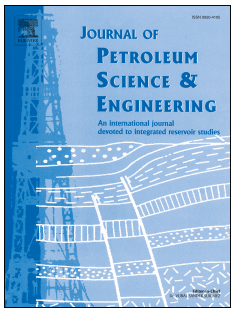
Accepted Manuscript



The mass and heat transfer characteristics of superheated steam coupled with non-condensing gases in perforated horizontal wellbores

Fengrui Sun, Yuedong Yao, Xiangfang Li, Lin Zhao, Guanyang Ding, Xuejiao Zhang

PII: S0920-4105(17)30523-5

DOI: 10.1016/j.petrol.2017.06.028

Reference: PETROL 4040

To appear in: *Journal of Petroleum Science and Engineering*

Received Date: 20 March 2017

Revised Date: 25 April 2017

Accepted Date: 12 June 2017

Please cite this article as: Sun, F., Yao, Y., Li, X., Zhao, L., Ding, G., Zhang, X., The mass and heat transfer characteristics of superheated steam coupled with non-condensing gases in perforated horizontal wellbores, *Journal of Petroleum Science and Engineering* (2017), doi: 10.1016/j.petrol.2017.06.028.

The Mass and Heat Transfer Characteristics of Superheated Steam Coupled with Non-condensing Gases in Perforated Horizontal Wellbores

Fengrui Sun[1a,b]*, Yuedong Yao[a,b], Xiangfang Li[b], Lin Zhao[a,b], Guanyang Ding[b], Xuejiao Zhang[b]

[a]*State Key Laboratory of Petroleum Resources and Engineering, China University of Petroleum, 102249 Beijing, P. R. China*

[b]*College of Petroleum Engineering, China University of Petroleum, 102249 Beijing, P. R. China*

ABSTRACT

In this paper, a novel mathematical model is proposed to analyze the flow behaviors of superheated multi-component thermal fluid (SMTF) in the perforated horizontal wellbores (PHWs). Firstly, a flow model comprised of mass, energy and momentum equations is established. Secondly, the proposed model is solved by finite difference method and iteration technique. Thirdly, the model is compared against previously published models and field data. Lastly, sensitivity analysis is conducted based upon the validated model. The results show that: (1). The predicted results from the novel model are in good agreement with field data. (2). The values of superheat degree along the PHWs decreases with increasing content of non-condensing gases. (3). Both the SMTF temperature and superheat degree increase with increasing of injection rate. (4). The SMTF temperature and superheat degree increase with increasing of injection temperature.

This paper unravels some intrinsic flow characteristics of SMTF in PHWs, which has a significant impact on the optimization of SMTF injection parameters and analysis of heat transfer laws in PHWs.

Keywords:

Wellbore modeling; perforated horizontal wellbore; superheated steam; non-condensing gases; sensitivity analysis

1. Introduction

In order to obtain a satisfactory oil recovery ratio, oil companies are constantly testing their new technologies, some of which have been proved to be very successful. Non-condensing gases assisted superheated steam injection for enhancing heavy oil recovery is exactly one of these new

*Corresponding author.
E-mail address: 13126682711@163.com (F. Sun).