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Simulation on Technical Limits of Multi-Molecular-Weight Polymer Flooding in Heterogeneous Multi-Layer Reservoirs in Daqing Oilfield

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Abstract

Being a heterogeneous multi-layer oilfield, Daqing Oilfield benefits remarkably from polymer flooding. However, for the low permeability oilfields with severe multi-layer and heterogeneity problems, applying molecular weight injection technology alone may cause uneven injection; and surface split injection may result in high cost. So, downhole separate polymer injection, as a multipurpose adjustment measure to minimize the heterogeneity, is feasible and necessary. And Daqing has successfully realized the downhole technology.

Even so, split polymer injection has not been technically defined on-site. So, in order to guide the implementation of the technology in the field, we conducted a numerical stimulation study on the relevant technical limit of the split polymer injection.

This paper mainly studies the following aspects: 1. plane split technology limit; 2. limit research on vertical split polymer injection technology; 3. impact of split polymer injection timing on polymer flooding effect, and has contributed to the application of heterogeneous multi-layer polymer flooding technology.

Introduction

Daqing Oilfield is a heterogeneous multi-layer oilfield. Polymer flooding in major reservoirs has demonstrated obviously good results. However, with the decline of the potentiality of polymer flooding in the major reservoirs, we have to conduct commercial polymer flooding with the secondary reservoirs (channel sand, and non-channel sand with net pay thickness above 1m and effective permeability above 0.1 μ m) based on pilot field tests during the ‘Tenth-Five-Year Period’ (from 2001 to 2005), to ensure sustainably high and stable production.

Due to the different depositional environments, the secondary reservoirs present different properties from the major reservoirs. The permeability of the major reservoirs differs insignificantly, which is suitable for choosing a certain single type of polymer to be injected in the majority of the reservoirs (fig.1). The permeability in the secondary reservoirs vary in a relatively wider range, and a single type of polymer can not cope with reservoirs with varied permeability, which shows the importance of different molecular weight polymers flooding technology for these kinds of reservoirs (fig.2).

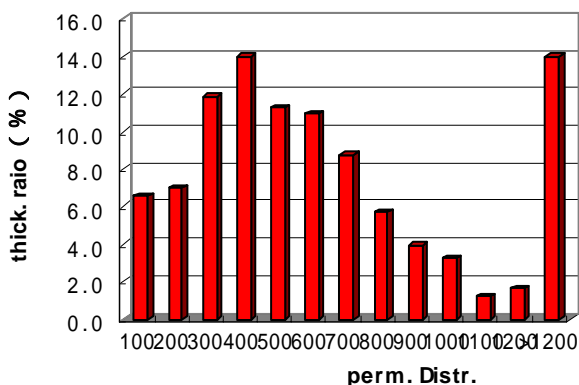


Fig.1 Perm. Distr. of major reservoirs

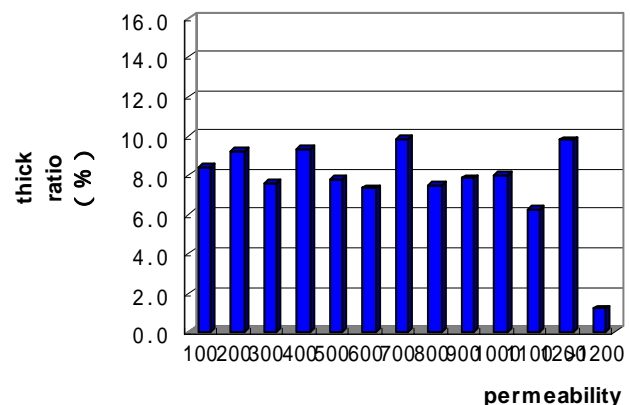


fig.2 Perm.distr. of secondary reservoirs