基于三维网络模型的水驱油微观渗流机理研究

侯健, 李振泉, 关继腾, 王克文, 陈月明

山东东营石油大学石油工程学院，257061

摘要   利用逾渗网络模型在微观水平进行随机模拟来研究水驱油的微观渗流规律，通过模型计算结果与油水稳态相对渗透率驱替实验结果对比验证了网络模拟的有效性. 在此基础上，讨论了在不同润湿条件下、水驱不同阶段的剩余油微观分布规律. 将剩余油分布形态归纳为4 种状态：孤粒/孤滴状、斑块状、网络状和油水混合状态. 研究表明，网络状剩余油的块数较少，但所占体积比例较大. 随着剩余油饱和度的降低，最大网络状油所占孔隙数减少，剩余油饱和度在40{\%}$\sim$50{\%}附近开始以较快速度减少. 润湿性不仅影响驱油效率，也影响剩余油分布形态. 在驱替过程中，剩余油分布总的变化趋势是逐渐趋于分散.

关键词   水驱油,微观模拟,渗流机理,网络模型,剩余油

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Water flooding microscopic seepage mechanism research based on three-dimension network model

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山东东营石油大学石油工程学院，257061

Abstract

  Water flooding microscopic seepage mechanism was researched by stochastic simulation on percolation network model at microcosmic level. The validity of network model was testified by the comparison of simulation and experiment of water-oil relative permeability steady flooding. Then, the microscopic distribution laws of remaining oil were discussed at different stages of water flooding and at different wetting situations. The forms of remaining oil distribution were divided into single grain (or single drop) shape, fleck shape, network shape and oil-water mixed shape. Research results show that the blocks of network shape remaining oil are less than other forms while occupying more volumes. Pores with max network shape remaining oil are reduced together with the reducing of remaining oil saturation and are reduced rapidly at about forty percent to fifty percent of remaining oil saturation. Wettability not only influences sweep efficiency, but also influences remaining oil distribution. The general change tendency of remaining distribution is becoming more and more dispersive.

Key words   水驱油   微观模拟   渗流机理   网络模型   剩余油

DOI:

通讯作者   houjian@hdpu.edu.cn

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