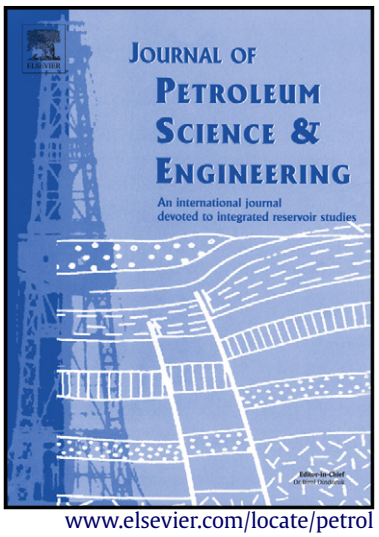

www.elsevier.com/locate/petrol

The application of laser confocal method in microscopic oil analysis

Yiqiang Li, Yan Yang, Xianda Sun, Dan Yang, Ning Zhang, Huaijun Yang, Hu Guo, Jie Zheng

PII: S0920-4105(14)00093-X
DOI: http://dx.doi.org/10.1016/j.petrol.2014.04.005
Reference: PETROL2633

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

Received date: 27 August 2012
Accepted date: 11 April 2014

Cite this article as: Yiqiang Li, Yan Yang, Xianda Sun, Dan Yang, Ning Zhang, Huaijun Yang, Hu Guo, Jie Zheng, The application of laser confocal method in microscopic oil analysis, *Journal of Petroleum Science and Engineering*, http://dx.doi.org/10.1016/j.petrol.2014.04.005

The normal optical microscope image of fluorescence analysis is used as the traditional method to analyze remaining oil distribution, but it has shortage of poor clarity, low resolution, unobvious color distinction between oil and water, unclear oil-water interface and cannot make quantitative research about the types and content of the remaining oil. With the improved fluorescence microscope and frozen slice of cores, laser confocal method for remaining oil analysis has superiority of clearer images, so it can clearly distinguish the oil-water interface , intuitively display the mineral form and microscopic remaining oil distribution. Based on this, self-developed software can quantify remaining oil content and total amount of oil and water. When the sample is representative and there are enough slices, the result can reflect remaining oil distribution of the selected oilfield area. With fluorescence detecting technology and stratified scanning, laser confocal analysis method can quantitatively quantify remaining oil and the ratio of light and heavy component of oil, distribution of oil and light component, 2D and 3D distribution map of oil and mineral and identify the remaining oil distribution in 2D and 3D, and intuitively display the characteristics of microscopic oil and water distribution in porous media. Through 3D imagine reconstruction of scanned real sample, the porous media and oil distribution can be reappeared. In this paper, we introduced a new method, the laser confocal method of analyzing remaining oil distribution. The comparison of this new method and traditional method shows that the new method has advantages of clear image, consecutive scanning, image reconstructing, multiple labeling technique and quantitative analysis. This method was applied to an oilfield to study microscopic remaining distribution in different layers of the reservoir. By analyzing the experiment data, we discuss the remaining oil distribution after using different displacing agents, and the effects of different displacing agents on light and heavy component of oil. The reconstructed 3D image can provide useful guidelines and suggestions for the remaining oil production.