

# NANO LEVEL STUDY OF OILS DISPERSE SYSTEMS USING NMR

Kashaev R.S.-H.

Kazan State Power Engineering University, Kazan, [kashaev2007@yandex.ru](mailto:kashaev2007@yandex.ru)

Urgent requirement of oil-industry laboratories - is possibility for express-analysis of nano level physical-chemical parameters (PCP) of oil disperse systems (ODS): interproton distances ( $\sim 0.15$  nm) in water droplets dispersed in emulsions of oil ( $\sim 0.26$  nm), pollutions of soils and waters. Method of pulse nuclear magnetic resonance relaxometry (NMRR) has great opportunities over others - nondestructive and noncontact, short time of measurement.

For the NMRR measurements in Construction Bureau of Resonance Complexes Ltd. we have designed portable, easily transported relaxometers NMR NP [1,2] (fig.1) with weight less, then 12 kg, power supplied from accumulator and connected with Notebook through LPT-port (fig.1) and USB-port. Relaxometers are used for measurement of interproton distances, relaxation times and proton populations and express-analysis of PCP. It has no analogues. In Kazan State University NMR NP-2 is used for educational process. They does not need sample preparation. Time of measurement – less, 2 minutes. Sensibility  $K = v^2 D^3$  [ $\text{MHz}^2 \text{cm}^3$ ] = 2700-4150  $\text{MHz}^2 \text{cm}^3$  is near to “Minispec pc120” (Bruker, Germany).



Fig.1. Portable relaxometer NMR NC-1

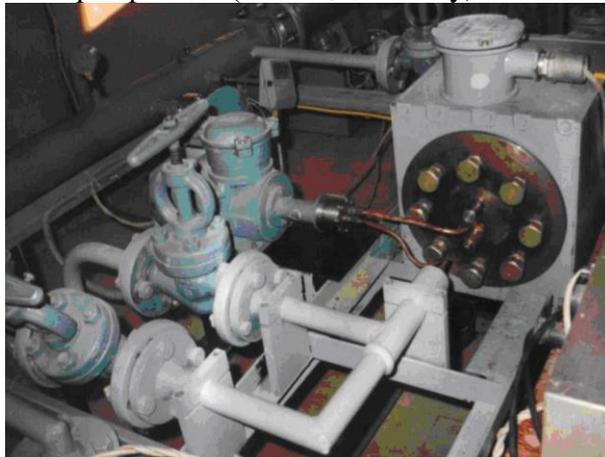


Fig.2. On-line flow NMR-analyzer

Crude oils emulsions are formed previously during the oil mining and changing conditions in an oil-well. Interproton distances and so the size of droplets is affected by energy dissipation as well the coalescence. So we are faced with a necessity to control this parameters.

This problems we tried to solve using Constructed by us on-line explosive and fire safe NMR-analyser (fig.2) [3,4], which was tested in real conditions of oil-mining plant in “Tatneft” company and also can be used for determination of physical-chemical properties of crude oil: water content in the range 4 - 100% with standard deviation  $S = \pm 1.5\%$ , gas content in the range 6 - 94% (error  $\pm 6\%$ ), droplets sizes distribution in the range 1000-15000 nm.

1. Kashaev R.S., Temnikov A.N., Idiyatullin Z.Sh.. Portable relaxometer of NMR. Patent of RF on useful model № 67719, 2006.
2. Kashaev R.S., Temnikov A.N., Idiyatullin Z.Sh.. Device for sample thermostating in probehead of magnetic resonance relaxometer. Patent of RF № 2319138, 2006
3. Kashaev R.S., Temnikov A.N., Idiyatullin Z.Sh.. NMR-analyzer for automatic control of Physical-chemical parameters of crude oil and bitumen / Extended Abstracts. 28-th Congress Ampere. University of Kent in Canterbury, UK, 1996. P.295.
4. Kashaev R.S., Temnikov A.N., Idiyatullin Z.Sh., Gazizov E.G. Method and device for operative control of oils and oil products components. Patent on invention of RF № 2411508, 2009.