Thermophysical Method for the Monitoring of Water Traces in Oils.

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The investigation was directed to elucidating the effect of volatile impurities on the thermal stability of superheated oils of different natures, searching for methods of pulse transition of a small sample volume into a superheated state optimum for the resolution of typical impurities (the most dangerous of which is water), and, on the basis of these methods, creating a device for the monitoring of volatile impurity traces in the working fluids of oil-filled equipment.

The well-known problem of the operation of thermal and electric power oil-filled equipment is connected with the change in the composition of oils both in the engineering processes and in the processes of transportation and storage. The contamination of an oil by volatile impurities (the most dangerous of which is water) results in a crucial reduction in the oil quality.

The method of controllable pulse heating of a wire probe has been used for systematic measurements of the thermophysical properties of various oils up to the temperature of attainable superheat (the temperature of spontaneous boiling-up of an oil) depending on the pulse length ($t \sim 0.01$-20 ms) and the parameters of the heating function $T(t)$. The investigated interval of water content is from 20 mg to 300 mg of impurity per kilogram of an oil sample. The equilibrium water content in mineral oils is at the level of 30 mg/kg.

A pulse heating regime accompanied by a high sensitivity to small water contents (including those at trace levels) has been revealed. This effect has been used as the base for the development of a procedure of volatile impurities monitoring and the creation of a device operating on the principle of a dangerous-content indicator.