

Investigation of Thermally Unstable Fluids by the Method of Controlled Pulse Heating: Critical Parameters for Multicomponent Liquids Including Oils

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The critical parameters of liquids are usually investigated for stable substances. However, in most practical applications one deals primarily with thermally unstable mixtures (the temperature of thermal decomposition onset for these substances is lower than the critical one). Because of the obvious experimental difficulties, the properties of these substances are less studied and a search for suitable methods for solving this problem is still in progress. The most reliable results for the critical parameters for thermally unstable pure liquids can be obtained by the method of pulse heating [1]. This method is based on tracking the evolution of the signal of spontaneous boiling-up of a liquid under stepwise pressure increase. This approach, however, becomes less efficient for multicomponent liquids characterized by significantly lower intensities of boiling-up. To overcome this limitation, we have designed new technique within the framework of the method of controlled pulse heating of a wire probe - resistance thermometer that we are developing [2]. The technique is based on the phenomenon of threshold changes in the properties of substance in the course of transition from sub- to supercritical state along the isobar. By selecting the probe heating trajectory and an increment in pressure, we find, at certain pressure value, a (reproducible in temperature and amplitude) signal indicating the entrance into supercritical region, and, as a result, the value of the critical pressure of substance. The corresponding value of critical temperature is calculated with an accuracy of 1%, as in the basic method [1]. The report discusses in detail the technique of measurement, its validation using substances with known critical parameters, and the results for a number of industrial oils used in power and refrigeration applications.

References

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