

Heat transfer coefficient of pulsed superheated aqueous emulsions of vegetable oils and biofuels

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The transition from hydrocarbon fossil fuels (HFF) to renewable energy sources is associated with a decrease in HFF reserves and an increase in negative environmental consequences from their use. One of the ways to solve the problem is to organize the production of water-fuel emulsions (WFE) using vegetable oils. The issues of obtaining WFE, mixture formation and combustion of emulsified fuels have not been fully studied. The heat transfer to aqueous emulsions of vegetable oils, as well as to binary solutions of biofuel components in the region of stable and relatively stable states in the case of short-term overheating relative to the liquid-vapor equilibrium temperature of one of the components is studied. Due to the use of a miniature heater based on a platinum wire heater with a diameter of 20 microns, the characteristic heating times are from 1 to 100 ms. Depending on the selected value of the exposure temperature, the heat transfer during pulse heating is determined by thermal conductivity and the complex heat exchange inherent in boiling. Using the method of controlled pulse heating of the probe, heat transfer coefficients were measured for aqueous emulsions of rapeseed and castor oils, as well as for binary solutions of these oils with isopropyl alcohol in the range of pulse heating temperatures up to 750 K and pressures up to 3.6 MPa. The investigation has been conducted at the expense of a grant of the Russian Science Foundation (project No. 23-69-10006), <https://rscf.ru/project/23-69-10006>