Experimental investigation dynamics of aerosols at oscillations in tubes in a no shock-wave mode

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Research wave dynamics in heterogeneous media near to resonance frequencies represents significant interest. One of ways on suppression of aerosols, it is especial in the closed volumes, acoustical coagulation and their deposition is. Results on acoustical coagulation and deposition of drops or particles of aerosols are in detail given in monographies (Mednikov, 1965; Temkin, 2005). Behaviour of an aerosol at their non-linear oscillations in tubes in basic were investigated in a shock-wave process near to resonance frequencies (Gulyaev and Kuznetsov, 1963; Temkin, 1970; Shuster *et al*., 2002; Gubaidullin *et al*., 2004). No shock-wave process when losses on walls become essential is insufficiently investigated. The purpose of the present work is studying features of coagulation and deposition of an aerosol in the closed and open tubes in a no shock-wave process on the first natural frequency.

The longitudinal established oscillations of an aerosol in a quartz tube in length of $L = 1.06$ m and a internal diameter of $2R = 0.0365$ m were generated by the flat piston. It was set in motion by vibrostand TV51075 (TIRA). Frequency and amplitude sine wave oscillations were set and controlled by means of program module SineVIEW, established on a computer, by means of the piezoelectric accelerometer and controller. The system of measurement of pressure of gas consisted of the pressure sensor, placed near to the piston, three-channel bridge amplifier of a voltage and digital oscillograph. For measurement of transparence the measuring complex consisting of the laser with wave length of 630 nm which was a light source and digital luxmeter was used. The ray of light passed perpendicularly axes of a tube through its middle and got in the centre of the sensor. The data from a luxmeter moved on a computer and were handled. Di-ethyl-hexyl-sebacate $C_{26}H_{50}O_4$ was used as the working fluid to generate aerosol. Aerosol with diameter 0.863 μm was created by means of the Atomizer Aerosol Generator.

The dependences of numerical concentration of drops of an aerosol on time are obtained at different importance of amplitude of displacement of the piston on an observable resonance frequency $\nu_1^* = 160.7$ Hz for closed tube and $\nu_1^* = 78.6$ Hz for open tube. The monotonic process of the decrease in concentration with time includes mainly the coagulation of aerosol droplets, their deposition on the tube walls, and the unsteady discharge of aerosol from the open end of the tube in the form of a pulsating jet. Is accepted, that time of variation of concentration is the time of a coagulation and a deposition of an aerosol in closed tube and the time of clearing of the aerosol in open tube. It is shown, that with increase of intensity of the oscillations, the caused increase of amplitude, time of coagulation and deposition and time of clearing of an aerosol decreases. The nonmonotonic pattern of the dependence of the time of coagulation and deposition and time of clearing on the frequency of excitation with a minimal value at resonance is observed (figure 1). It is found that the time of coagulation and deposition aerosol in the closed tube by 2-4 times and time of clearing aerosol in an open tube by 6-12 times lower than at natural depositing.

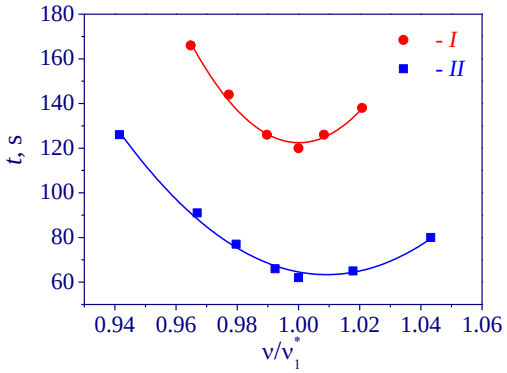

Figure 1. Dependence of time of coagulation and deposition (*I*) and time of clearing (*II*) of an aerosol on frequency of excitation for amplitude of displacement of the piston $l = 0.3$ mm. Line – polynomial approximation.

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