

CLUSTER REGIME – THE NEW REGIME OF FLOWING OF GAS-LIQUID  
MIXTURE IN VERTICAL COLUMNS (BASED ON EXPERIMENTAL DATA)

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For the revealing of the reasons of occurrence of discrete volcanic explosions of basalt magma the Complex Apparatus for Modeling Basaltic Eruptions (CAMBE) has been developed. It consists of two major systems – modeling and recording. The device is 18 meters high. During experiments gas-saturated model liquid acts from the saturator to the vertical transparent hose in which arising two-phase structures and its kinetics are studied.

The experiments resulted in detecting and describing a new, never before known, mode of gas-liquid two-phase flow in a vertical column – defined here as cluster regime, which is characterized by regular alteration of dense gas bubble clusters separated from each other by the liquid not containing free gas phase. The mechanism of the cluster regime formation is conditioned by the processes of blocking of the hose working section by one big bubble or several smaller ones. It has been demonstrated that liquid, bubble, cluster and slug regime are regularly sequential and present polymorphic modifications of gas-saturated liquids migrating within vertically oriented conduits.

Analysis of data on explosions at volcanoes, given the obtained experimental data on the mechanism of this process, allows concluding that realization of cluster or slug regimes in volcanic crater produces basaltic explosions.