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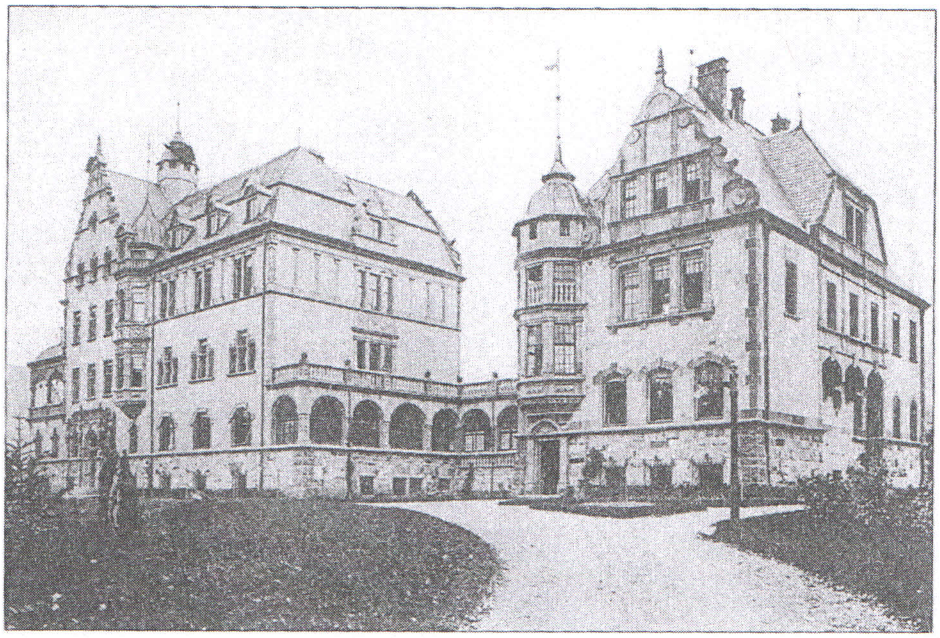

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Diffusion and convective instability in multicomponent gas mixtures at different pressures

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I. INTRODUCTION

Concentration gravitational convection in isothermal binary mixes is defined by the traditional mechanism of mixture displacement. Heavy gas falls, and light rises. Stabilization of convection takes place in case, when lighter mixture of gases reaches the upper position. The addition of a third component to the mixture can lead to the emergence of new effects which contradicts the traditional representations [1]. Studying the velocity of diffusive leveling of concentrations of components at different pressures in two flasks of the device connected by the vertical channel [2] the gravitational concentration convection was recorded [3].

II. EXPERIMENTS

Experiments were carried out on two flasks realizing system devices [2]. As a rule, in the upper flask was placed the binary mixture of a light and heavy component. The average on density gas was in the lower flask. Selection of concentrations of components in binary mixture in all cases achieved smaller density in the upper flask. Pressure and temperature in flasks were supported identical. The technique of carried out experiments corresponded to the traditional scheme. The composition of mixture in flasks was registered from time to time when the capillary opened. Experimental concentrations are normalized on the values, calculated at diffusion on Stephane-Maxwell's equations. Thus the received dimensionless ai parameters characterize the corresponding type of mixture displacement. Diffusion takes place, if $\alpha_i \approx 1$. Research of dependence of $\alpha_i$on pressure P showed that at a certain critical P_{cr}value the α_i parameter exceeds unit. Mechanical balance of mixture becomes unstable. There arises an abnormal concentration gravitational convection. If to investigate the convective mixture displacement at pressure considerably exceeding critical, then primary transfer of the heaviest on density component is fixed.

III. THEORY STABILITY

Emergence of convection at diffusion in mixture can be explained within the theory of stability [1]. The transition parameters defining the change of "diffusion-convection" modes are turned out from the joint solution of the equations of mechanics of the continuous medium and the equation state medium which is written down for three-component systems. Linearizing the system of equations of hydrodynamics in relation to small perturbations we will receive a uniform (homogeneous) system of the linear differential equations with independent of time coefficients, which have $exp(-i\omega t)$ solution. If among found $\omega = \omega_0 + i\omega_1$exist such for which $\omega_1 > 0$, then the state will be unstable. The borders of change of the diffusive and convective modes defined in terms of Rayleigh numbers, $R_i$shows that at some conditions the mechanical balance of mixture can be unstable, that causes convection emergence.

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