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OCCURRENCE OF CONVECTIVE FLOWS IN TERNARY LIQUID AND GASEOUS MIXTURES UNDER ISOTHERMAL CONDITIONS

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INTRODUCTION

Analysis of the onset of instability during the isothermal interdiffusion has shown that when the system has only one constant thermodynamic force ∇c causing convection then the description is completely analogous to the usual thermal convection. In the case of the two forces ∇c and ∇T at the same time there are new effects which essentially comes to and including the fact that the convectively unstable states are possible and the negative direction of the density gradient (mixture is more dense at the bottom). In this case, for the occurrence of thermo concentration convection there are two reasons both the heterogeneity of temperature and concentration. Since isothermal diffusion in ternary mixtures is also characterized by the presence of two independent partial concentration gradients, it seems important to analyze the most characteristic moments that arise in the study of the phenomena of convection class known as "double diffusion".

EXPERIMENTAL DATA

Convective instability in isothermal liquid mixtures has been studied in practice at aqueous solution diffusion of salt and sugar in a vertical plane channel. A set of pictures obtained by Tepler's shadow method are shown in Fig. 1. The lower part of the channel is filled with an aqueous salt solution (ρ = 1.125 g/cm^3), and the upper part with water solution in 3 parts of salt and 1 part of sugar (ρ = 1.057 g/cm^3). Fig. 1a shows the initial mixture in the cell. First, a salt solution is poured, and then along the wall of the cell a lower density of salt and sugar solution is added. At the edges of the cell is clearly observed the boundary of liquids. Diffusion starts, but after 10-15 seconds there can be seen convective instability in the system. Further observation over the system indicates the presence of structured convective flows.

More information is got at the result of experiments on studying the instability of mechanical equilibrium in gases. A vertical flat channel connected two identical flasks. At the top of the flask was a binary mixture of light and heavy components. Average density gas was placed in the lower flask. Concentrations of light and heavy components were chosen so that the mixture in the upper (top) flask was always of lower density of the gas than in the lower (bottom) flask ($\rho < 0$). Pressure is the same in both flasks. The channel connecting the flasks opened. After some time, the channel was blocked and the mixture in both flasks was recorded. Concentrations got at the result of experiments were normalized to the calculated assuming diffusion. Figure 1d shows the typical