# Experimental and numerical study of the peculiarities of the multicomponent gas mixtures separation under natural gravity convection

**V N Kossov[1], S A Krasikov[2], O V Fedorenko[2], D B Zhakebaev[3] and M K Asembaeva[2]**

[1] Abai Kazakh National Pedagogical University, Almaty, Kazakhstan
[2] Institute of Experimental and Theoretical Physics at al-Farabi Kazakh National University, Almaty, Kazakhstan,
[3] Al-Farabi Kazakh National University, Almaty, Kazakhstan

E-mail: kosov_vlad_nik@list.ru

**Abstract**. Experimental study of the features of separation process in ternary gas mixtures $0.6179 \, H_2 + 0.3821 \, N_2 - CH_4$ and $0.7760 \, CH_4 + 0.2240 \, R12 - n\text{-}C_4H_{10}$ is conducted. Conditions of the priority transfer of the density heaviest component of the mixture are discussed. The problem is solved by the splitting scheme by physical parameters. Numerical data on the time evolution of components concentrations at different concentrations of components of the initial mixture are obtained. Calculations have shown that for ternary systems the concentration increase of the heaviest component results to the intensity growth of convective mixing.

## 1. Introduction

The description of isothermal diffusion in multicomponent mixtures is described by the Stefan-Maxwell equations [1] and, in comparison with binary systems, has a number of features [2], which consist in the absence of component transfer at a nonzero concentration gradient; transferring a component with the zero value of its gradient; bidirectional (reverse) diffusion. Another manifestation of special modes of multicomponent diffusion is the appearance of convection leading to a synergistic effect associated with a significant increase in the mixing speed of the components of the system [3]. Experiments and numerical studies on the vapor diffusion of binary solutions into an inert gas [3, 4] have shown the possibility of the occurrence of convective instability in such systems. The effects described in [3, 4] are consistent with the results given in [5, 6] in which the appearance of structured convective currents is considered when changing the "diffusion-convection" regimes at different pressures and compositions.

In this paper, experimental data on the study of isothermal diffusion and convective mixing in multicomponent gas mixtures $0.6179 \, H_2 + 0.3821 \, N_2 - CH_4$, $0.7760 \, CH_4 + 0.2240 \, R12 - n\text{-}C_4H_{10}$ are presented. By the methods of 2D modeling, the possibility of the appearance of structured convective flows in the course of diffusion at various mixing times is studied numerically.