CHANGE OF EXTERNAL FLOWS OF THE SEPARATION CASCADE TO REDUCE THE TRANSITION PROCESS DURATION

Ushakov A.A.[1,2], Orlov A.A.[2], Sovah V.P.[1]

[1]Joint Stock Company «Production Association «Electrochemical Plant»,

[2]National Research Tomsk Polytechnic University

E-mail: ushakovaa2015@sibmail.com

Recently, isotope-modified materials have been widely used in nuclear energy, medicine, and basic research. The change in the composition of the isotope mixture occurs in the process of its separation by any method. In recent decades, the interest of researchers has been riveted to the separation of multicomponent isotopic mixtures (MIS) in cascades of gas centrifuges (GC).

The stationary mode of separation of MIS in the GC cascade is preceded by a non-stationary process, which can conditionally be divided into two stages: 1 - filling the cascade with a working substance, 2 - transition process, during which stationary values of the concentrations of the components of the isotopic mixture in the steps and flows of the cascade are established. Of particular interest is the study of the transition process in view of its considerable duration and, as a consequence, a significant negative impact on the efficiency of the GC cascade. The transition process is an unsteady hydraulic and separation process, during which the values of the flows and pressures of the working substance and the concentrations of the components change.

This paper presents the results of studies to determine the effect of external cascade flows on the duration of the transition process using a mathematical model. The studies were carried out for the case of separation of germanium isotopes, which are used to create semiconductor materials and to study neutrinoless double β-decay.

The influence of the values of the feed flows and the light fraction of the cascade on the time to achieve the desired concentration of 72Ge was shown. It was found that the duration of the transition process is reduced by about 4 times with an increase in the supply flow by 20% and the maximum value of the light fraction flow. The transition process can be represented as the transfer of a desired isotope in the direction of the stage of selection of light or heavy fractions, accompanied by the accumulation or removal of an excess of this isotope from the cascade with an increase or decrease in its maximum concentration in the cascade.