In 1996, NPO Geliimash (Scientific Production Association of Helium Machinery) began series production of a new generation of cryobiological Dewar flasks that differ from those produced by Korostenkhimmash in having improved technical and economic indices and design. The decision to produce such flasks was taken in view of drastic cut in flask production in Ukraine and discontinuation of their supply to Russia.

The flasks are designed to store and transport bioproducts in liquid nitrogen and are used in the technology of artificial insemination of farm animals. High cost of bioproducts imposes stringent demands on the working characteristics of the flasks, primarily on the magnitude of nitrogen loss due to evaporation, and dictates a number of their special features.

The design of a cryobiological flask for agricultural purposes (SDS flask) is shown in Fig. 1. The flask is made of an aluminum alloy, and has a fiberglass vacuum-tight neck and a highly effective heat insulation. An adsorbent and a hydrogen absorber are placed in the insulation cavity. A vacuum valve allowing ultra-vacuuming of the flask is placed on the jack-tet. Cans for storing the bioproduct are put in the flask. The flask neck is closed by a lid having a foam-plastic plug.

The fiberglass is joined with the aluminum tips by cold-straining applying a technology developed by the NPO Geliimash. For neck-making, a specialized facility has been created that includes a section for winding of fiberglass collars and press-fitting of tips.

The strength factors of the necks allow for surface and air transportation, and the low gas-permeability of the fiberglass helps maintain the residual pressure in the insulation at the \((2–5) \times 10^{-7}\) Pa level throughout the flask operation time.

The flask insulation system is a vacuum-multilayer insulation comprised of 7-µm-thick aluminum foil and SNT-10 synthetic paper with built-in soft screens made of the same aluminum foil. The screens rest on aluminum side plates, which can be attached to the neck in the insulation laying process and which are in good thermal contact with the neck. Furthermore, in the winding process, the insulation in the neck area stretches all across the height of the working part of the neck and fits snugly to the neck wall. The side plates of the screens rest on the ring-shaped projections of the neck surface, which rules out the possibility of slipping of the insulation in the transshipment process.

The thermal contact of the insulation with the neck substantially enhances (more than twice) insulation efficiency on account of utilization of the cold of the nitrogen vapors. The measured temperature dependencies of the coefficients of thermal conduction of some textures of the vacuum-multilayer insulation, which utilizes the cold of the nitrogen vapors, with
the aluminum-foil screens and various packing materials show (Fig. 2) that insulation with packings from SNT-10 synthetic paper is the most efficient. Comparative tests have demonstrated that in terms of thermophysical properties this paper is not inferior to the American Cryotherm glass paper (sand cloth).

A calculation procedure has been developed for multiscreen insulation systems cooled by outgoing vapors. It makes possible prediction of the key operational parameters of the flasks with a precision of 5–8%. Developed as well is a software for automated calculation and designing of flasks.