Cryogenic Vacuum Sistems, Technologies and Equipment

Guram N. Dgebuadze

I.Vekua Sukhumi Institute of Physics and Technology, Georgia, Tbilisi.

Abstract.
In the SIPT were elaborated and manufactured the equipments for vacuum techniques and vacuum technologies. They have very high physical and technical characteristics which make them irreplaceable for modern science and technology. Potential customers of them are scientific-researcher, industrial and technological centers, universities, the companies-manufacturers of the microelectronics, spraying technologies, medicine, food-processing industry, etc. where special requirements are put to vacuum and working environment.

Keywords: *vacuum, adsorption, cryvacuum, pump, chamber, equipment.*

The modern stage of vacuum engineering is characterized by important features of increase requirement of obtaining and conservation of vacuum. For creation high and ultrahigh oilless pumping means with a long work resource and small consumption of coolant there is necessary to solve thermo- physical and other task, investigation of materials for pumps manufacture, modernization of surface technology of cryconstruction materials, choice the ways of decreasing of heat input and elaboration of pumping means construction.

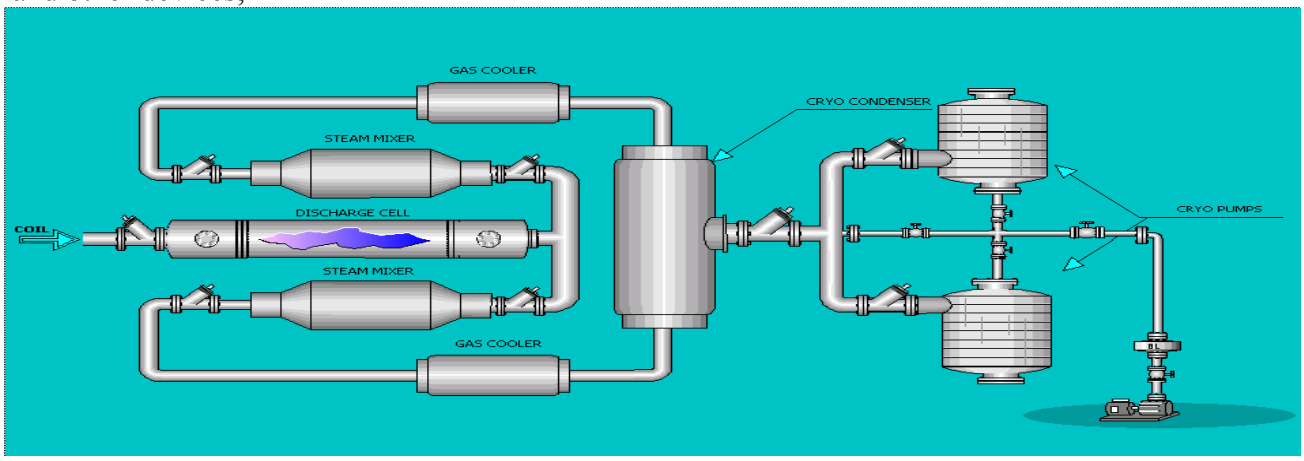
On the base of successful solution of above pointed problems in I.Vekua Sukhumi Institute of Physics and Technology (SIPT, Georgia, Tbilisi.) there were conducted, elaborated and manufacturing following equipments:

- High efficiency Complex of Cryovacuum Pumping System (CVPS);
- Superhigh vacuum priming cryocondensing-sorption pumps cooled by liquid helium;
- Superhigh vacuum sorption pumps cooled by liquid nitrogen;
- Superhigh vacuum sorption pumps cooled by solid nitrogen;
- Superhigh vacuum technological chambers made of stainless steel and titan.

Innovative Aspects and Main Advantages

- **High-efficiency Complex of Cryo-Vacuum Pumping System (CVPS).**

CVPS is intended for pumping a plenty of a gas mixture with a stream up to 1.2M (Mach) at the temperature of 600K. For example: chemical laser COIL, imitating and other devices;



- **Superhigh vacuum priming cryocondensing - sorption pumps cooled by liquid helium**
  A range of their working pressure is from 10^{-3} up to 10^{-11} Pa. There have been developed and manufactured three various modifications with the pumping speed from 5.0 up to 10.0 $м^3$/sec. One priming of liquid helium into the cryo-pump is enough for its continuous work from 2 to 4 months.

- **Superhigh vacuum sorption pumps cooled by liquid nitrogen**
  A range of working pressure is from 760 up 10^{-1} Pa, or from 1 up to $5 \cdot 10^{-5}$ Pa. Pumps are most effectively used in continuous, stand-by regimes, as they have a very low vapor ability of liquid nitrogen. One priming of it into the pump is enough for 3 (three) days of continuous work. 5 (five) modifications of such pumps have been developed with the pumping speed from 0.1 up to 8.0 $м^3$/sec. High sorption capacity of these pumps allows to accomplish the several hundred cycles of pumping without their regeneration at their use in a range of working pressure from 1 up to 10^{-4} Pa.

- **Superhigh vacuum sorption pumps cooled by solid nitrogen**
  A range of their working pressure is from 10^{-1} up to $5 \cdot 10^{-7}$ Pa. In these pumps adsorbent is cooled by solid nitrogen at the temperature 47-55K and it has the sorption capacity greater then four degree at nitrogen and hydrogen, than the same adsorbent at temperature of liquid nitrogen (77,4K). Such pumps are created for pumping of argon, nitrogen, freon, and aggressive gases (H_2S, F, HF) and so on in the plasma chemical.

- **Superhigh vacuum technological chambers made of stainless steel and titan**
  We have created a number of superhigh vacuum chambers with capacity from several liters to several $м^3$. The surface of these chambers had been covered through special technology by aluminum film with very low adsorptive-desorptive ability of water vapor and other gases. Due to that, the pressure had reached from 10^{-6} up to 10^{-9} Pa in chambers without warming up, even if they had been left on the open air for a long period.

There are no need in the energy carrier and cooling water for cryogenic pumps during working process. They can work uninterruptedly in the stand-by mode. Complete absenceof noise and vibration makes a comfortable condition for servicing personnel.

References

1. Dgebuadze G. High Productive Cryosorption Pumps of Dismountable Construction. Bulletin of Georgian Academy of Sciences, 1998, vol. 3, no. 158, p 390-392.
2. Dgebuadze G. High Performance Cryosorption Pump. “Cold Facts” USA, 1999, vol. 5, №5, p8,9,28.
3. Dgebuadze G., Augustiniwicz S., Salukvadze R. and others. High Performance Cryosorption Pumps. The Sixth LLR International Conference “Cryogenics-2000” Praha, October 2000, p26-29
4. Dgebuadze G., Janjgava B., Kashia V. Cryogenic Condensation-Sorption pumps with Advanced Coefficient of capture By H_2 and He. The Seventh IIR International Conference “Cryogenics-2000” Praha, April 2002, p33-36.
5. Dgebuadze G. and other. Modeling of molecular flows in the channels of cryosorbtion pump NCS-1D. Georgian Engineering News, 2009, N3, p67-70.
6. G. Dgebuadze and other. Engineering designs of thin-welled cryogenic pumps. Georgian Engineering News, 2009, N3, p71-75.
7. Dgebuadze G., Tsakadze L. Thermophysical Calculation of Cryosorbsion Pumps. Bulletin of Georgian National Academy of Sciences, 2009, vol.3, no.3, p.76-80

Article received: 2009-12-21