

---

# Biocrystal growth apparatus installing with active control of the crystallization process

© I.Zh. Bezbakh<sup>1</sup>, B.G. Zakharov<sup>2</sup>, V.I. Strelov<sup>2</sup>, O.V. Kritskiy<sup>1</sup>,  
I.N. Radchenko<sup>1</sup>

<sup>1</sup>Kaluga Branch of Bauman Moscow State Technical University, Kaluga, 248000, Russia

<sup>2</sup>"Space Materials" Science and Research Center of Shubnikov Institute of Crystallography, Russian Academy of Sciences, Kaluga, 248640, Russia

*The main purpose of the article is to analyze the problems and factors determining the quality and structural perfection of protein crystal. Special attention is paid to crystallization processes by means of temperature. We consider the equipment and methods of protein crystallization employed in our country and abroad. The findings of this research led to developing a method of controlled protein crystallization, which allows real-time division of nucleation and crystal growth processes. This method does not require large amounts of protein solutions and excludes the possibility of crystal damage during diffraction studies. The construction of such apparatus implements a modular principle: better throughput is achieved by aggregation of single-type blocks. Their basic design allows modernizing and upgrading for increasing the number of growth cells and using diagnostic and test equipment.*

**Keywords:** protein, crystal, growth, control, mathematical modeling.

## REFERENCES

- [1] Kuranova I.P. *Poverkhnost'. Rentgenovskie, sinkhrotronnye i neutronnye issledovaniya — The Journal of Surface Investigation. X-ray Synchrotron and Neutron Techniques*, 2004, no. 7, pp. 4–12.
  - [2] Chayen N.E. *Current Opinion in Structural Biology*, 2004, vol. 14, pp. 577–583.
  - [3] Bezbakh I.Zh., Kosushkin V.G., Zakharov B.G. Optimizatsiya rosta kristallov belkov s primeneniem metoda teplovogo upravleniya [Optimization of protein crystal growth using the method of thermal control]. *Metody issledovaniya i proektirovaniya slozhnykh tekhnicheskikh sistem. Sb. statei* (Trudy MGTU № 592). [Research and design methods of complex technical systems. Collection of articles (MSTU Proc. No. 592)]. Moscow, Bauman MSTU Publ., 2006, pp. 18–26.
  - [4] Rosenberger F., Howard S.B., Sowers J.W., Nyce T.A. *Journal of Crystal Growth*, 1993, vol. 129, pp. 1–12.
  - [5] Luft J.R., Rak D.M., DeTitta G.T. *Journal of Crystal Growth*, 1999, vol. 196, pp. 447–449.
  - [6] Strelov V.I., Zakharov B.G., Bezbakh I.Zh. *Kristallografiya — Crystallography*, 2008, vol. 53, no. 1, pp. 145–148.
  - [7] Bezbakh I.Zh., Strelov V.I., Zakharov B.G. Rentgenodifraktsionnaya kharakterizatsiya kristallov belkov, vyrashchennykh metodom upravleniya temperaturoi [XRD characterization of protein crystals grown by temperature control]. *Sovremennye metody analiza difraktsionnykh dannykh i aktual'nye problemy rentgenovskoi optiki: materialy VI-go mezhdunarodnogo nauchnogo seminarra 19–27 avgusta 2013 g.* [Modern methods of diffraction data analysis and actual problems of X-ray optics: Materials of the VI International Scientific Seminar 19–27 August 2013], Veliky Novgorod, 2013, pp. 206–208.
-

---

**Bezbakh I.Zh.** (b. 1978) graduated from Kaluga Branch of Bauman Moscow State Technical University in 2001. Ph.D., Assoc. Professor of the Physics Department at KB of Bauman MSTU. Author of several articles on the methods and apparatus of growing crystals (semiconductors, crystals of biological materials). e-mail: biz001@mail.ru

**Zakharov B.G.** (b. 1937) graduated from Leningrad State University named after A.A. Zhdanov. Dr. Sci. (Eng.), Chief researcher of "Space Materials" Science and Research Center of Shubnikov Institute of Crystallography, Russian Academy of Sciences. Author of over 200 scientific papers in the fields of crystal growth and solid state physics. e-mail zakharov@kaluga.rosmail.com

**Strelov V.I.** (b. 1952) graduated from National Research University of Electronic Technology. Dr. Sci. (Phys.-Math.), Director of "Space Materials" Science and Research Center of Shubnikov Institute of Crystallography, Russian Academy of Sciences. Author of over 150 scientific papers in the fields of crystal growth and solid state physics. e-mail strelovvi@kaluga.ru

**Kritskii O.V.** (b. 1993), 4th year student of Kaluga Branch of Bauman Moscow State Technical University, specialty 210201 "Design and technology of radio electronic devices". Research interests correspond to the future profession. e-mail: jungarik93@list.ru

**Radchenko I.N.** (b. 1961) graduated from the Leningrad Polytechnic Institute named after M.I. Kalinin. Ph.D., Assoc. Professor of the Physics Department, Kaluga Branch of Bauman Moscow State Technical University. Author of more than 40 scientific papers in the areas of electronics and solid-state physics. e-mail: rin-kf@yandex.ru

---