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N. V. Usoltseva [a], S. A. Syrbu [a] & N. V. Zharnikova [a]
[a] Ivanovo State University, Ivanovo, Russia

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Ivanovo State University Experience in Training of Specialists in Liquid Crystals

N. V. USOL'TSEVA, S. A. SYRBU, AND N. V. ZHARNIKOVA

Ivanovo State University, Ivanovo, Russia

During the last 50 years the interest towards LC and their application has increased all over the world. In spite of the rapid development in this branch of science in Russia, there is no concept of specialist training in the sphere of liquid crystals. Ivanovo State University develops the specialist training in this sphere on the basis of interdisciplinary approach. The graduates and specialists who finish their post-graduate education possess high innovative ability. It allows them to be in-demand not only in their LC specialties but also in allied spheres of science.

Keywords Education; interdisciplinary approach; liquid crystals

1. Introduction

Training of the specialists in the sphere of Liquid Crystals was not accidentally implemented at Ivanovo State University (IvSU). The first LC laboratory in USSR was founded in IvSU in 1964. Prof. Chistyakov was the founder and the head of the laboratory. Hereafter he also founded a liquid crystal laboratory at the Institute of Crystallography of the Russian Academy of Sciences.

At that time Prof. Chistyakov was already an active participant of international conferences. He established contacts with a number of leading foreign scientists such as Prof. Demus, Prof. Sackmann, Prof. Chandrasekhar, etc. This contributed to the successful development of the liquid crystal science at the laboratory of Ivanovo State University. This laboratory was unique because the specialists in physics, chemistry and application of Liquid Crystals closely cooperated here.

During the last 50 years the interest towards LC and their application has increased all over the world. It is impossible to imagine the development of electo-optics, nanotechnologies and supramolecular chemistry without it.

In spite of the rapid development in this branch of science in Russia there are few examples of specialist training in the sphere of liquid crystals. In the recent years this issue has become very urgent. Firstly, the young people's interest in the natural sciences has decreased: most of them want to become lawyers and economists.

Address correspondence to N. V. Usol'tseva, Ivanovo State University, Ermak str. 39, Ivanovo 153025, Russia. Tel.: 007-4932-370808; Fax: 007-4932-324677; E-mail: nv_usoltseva@mail.ru

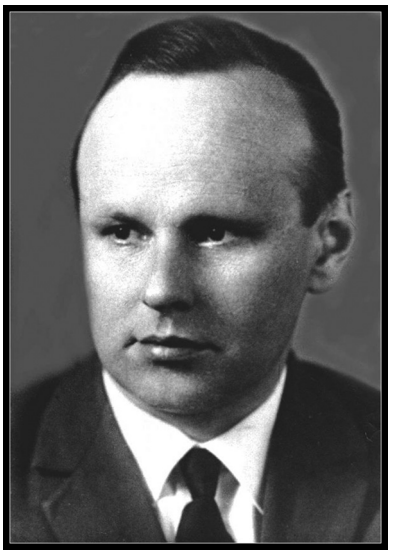

Figure 1. Prof. I. G. Chistyakov (1929–1982).

Secondly, the demographic collapse is leading to the reduction of those entering faculties of physics and chemistry.

That's why we tried to develop a strategy of training of specialists in the field of liquid crystals and founded educational and scientific centre "Liquid Crystals" in 2000.

2. Research Education Centre "Liquid Crystals"

The centre unites teachers of Physics and Chemistry faculties as well as the scientists of the Institute of Nanomaterials at Ivanovo State University. Moreover, among the members of the centre there are representatives of Institute of Solution Chemistry of the Russian Academy of Science (ISC RAS), Ivanovo State University of Chemistry and Technology (ISUCT), and Ivanovo State Textile Academy (ISTA).

The main objectives of this center are:

– Creating conditions for training and retraining research and education specialists in the field of mesomorphic nanomaterials;
– Integration of the scientific potential and modern equipment of the participating institutions to focus the researchers' efforts on the most burning problems in the sphere of mesomorphic nanomaterials and to guarantee their high experimental level;
– Creating conditions for students' and PhD students' active participation in the research. Elaboration of a special system to increase young students' motivation in scientific work;
– Joint implementation of innovations in the field of research and education connected with the elaboration of new nanomaterials and compositional materials on the base of liquid crystals;
– Development of academic mobility and international collaboration.

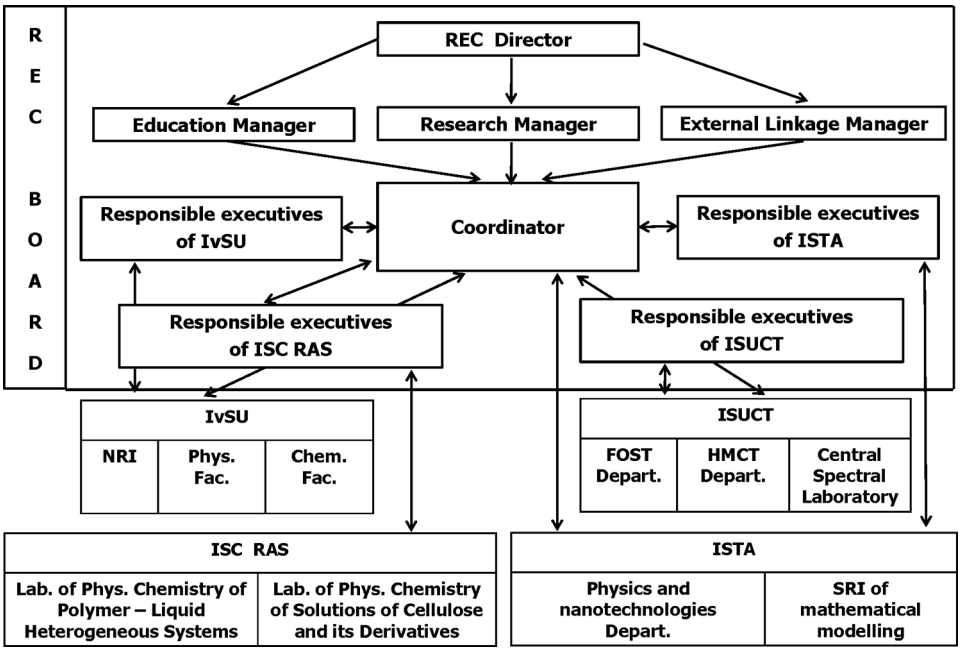

Figure 2. Research Education Centre "Liquid Crystals."

We develop training of specialists in the sphere of liquid crystals on the basis of the following three principles: early motivation to the study of liquid crystals, interdisciplinary approach and internationalization in science.

We distinguish three main stages of training of specialists in the sphere of liquid crystals.

The first stage is connected with the work with pupils and teachers.

We try to invite small groups (even 2–7) of pupils' who show interest in natural sciences inviting them to get acquainted with the university and organizing classes like "Amusing Physics" and "Introduction into the World of Chemistry".

Pupils at the age of 13–14 are engaged in the nanotechnology class. We deliver to them lectures and lessons dedicated to the basis of liquid crystals. At the same time we organize classes with teachers of physics and chemistry improving their knowledge of the modern conceptions of liquid crystals and nanomaterials in general.

The second stage is the training of bachelors and masters. Theoretical courses in physics and chemistry of liquid crystals are given by lecturers whose research interests are connected with mesomorphic state of the matter. Basic training of students at the courses connected with liquid crystals:

– Chemistry of liquid crystals;
– Mesomorphism of compounds;
– Thermodynamics basis of liquid crystals;
– Lyotropic mesomorphism;
– Physics of liquid crystals.

The students participate regularly (once a year) in Chistyakov's contest for the best student work in the sphere of liquid crystals. The students present their reports during the "Young Scientist" festival.

Figure 3. 2–7-Form pupils interest to the natural sciences. (Figure appears in color online.)

For the last 6 years we have been holding international conferences in the sphere of liquid crystals with the elements of scientific school. We consider it is very important that being already university's students young people have an opportunity to communicate with the leading Russian as well as foreign scientists in the field of liquid crystals.

We have been cooperation with such leading foreign and Russian scientists as Prof. T. Bellini, Prof. K. Praefcke, Prof. I. Abdulhalim, Dr. I. Dierking, Associate Prof. T. Hanasaki, Prof. V. P. Shibaev, Prov. Yu. M. Evdokimov, Prof. A. S. Sonin, etc. It raises significantly their motivation and interest to the liquid crystals science.

Term papers and graduation projects are made on the basis of LC-branch of Nanomaterials Institute and in Institute of Solution Chemistry of the Russian Academy of Science.

The third stage is post-graduate education aimed at scientific and pedagogical work. Preparation of Ph.D. theses on liquid crystals is closely connected with academic mobility. It can be of international (support with international grants) or national character. Our PhD students worked in the university laboratories of York, Bayreuth, at Vladimir University, Moscow State University, etc.

We have close scientific contacts with institutions of the Russian Academy of Sciences in Moscow, St. Petersburg and with the institutes of higher education in Central Russia. At the Institute of Crystallography of the Russian Academy of Sciences our post-graduate students took part in a scientific conference.

Figure 4. "Young Scientist" festival. (Figure appears in color online.)

Scientific seminars held regularly by the Research and Educational Centre also make a great contribution to the Ph.D. theses preparation. Reports are made by both PhD students and leading scientists of Ivanovo, Russia and foreign countries.

Figure 5. Prof. D. Bruce (University of York, UK) addressing audience. (Figure appears in color online.)

Figure 6. Summer school on liquid crystals for students and PhD students. (Figure appears in color online.)

Then, summer school on liquid crystals for students and PhD students is a relatively new form of work. We hold them on the bank of a picturesque lake where the university summer camp is situated.

The opportunity to work with manuals and monographs on liquid crystals published in IvSU also promotes the training of students and PhD students in the sphere of liquid crystals.

The ''LC and their application'' journal issued in IvSU together with International Liquid Crystal Society Commonwealth promote the dissemination of research data of academicians and postgraduate students (http://nano.ivanovo.ac.ru).

The graduates and specialists who finish their post-graduate education possess high innovation ability. It allows them to be in-demand not only in their LC-specialties but also in allied spheres of science.

This manuscript has not been published elsewhere and it has not been submitted simultaneously for publication elsewhere.