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### **Brief summary of activity:**

In 1958 as a fourth-year student he published his first scientific paper.

In 1959 he graduated from physics and mathematical faculty of Chernivtsi University.

In 1961 meetings with academician Ioffe determined the scientific priority in the life of L. Anatyuk - thermoelectricity.

In 1964, on finishing post-graduate studies, he defended his PhD thesis dedicated to anisotropic thermoelements and their materials.

Since 1965 he has been delivering lectures at Chernivtsi University.

In 1968 he took charge of Basic research laboratory of Chernivtsi University including 70 people, where the works on basic research in thermoelectricity were pursued.

At that time L. Anatyuk realized basically new approach in the description of thermoelectric energy conversion effects, based on the generalization of Faraday's fundamental law of electromagnetic induction. Afterwards it formed the basis for a generalized theory of thermoelectric energy conversion created by L. Anatyuk. The consequence of this theory was full classification of all kinds of thermoelectric energy conversion in the form of a table that similarly to Mendeleev's table in chemistry allowed predicting new variants of thermoelectric power converters and realizing systemic approach when planning research in thermoelectricity. On the basis of the generalized theory, methods for the discovery of basically new thermoelement types based on thermoelectric current induction were developed. In this way more than 20 new thermoelement types were devised that enriched considerably the element basis of thermoelectricity. They were patented in the USA, Japan, Great Britain, France, etc. They expanded the areas of practical applications of thermoelectricity.

In 1973 he defended his doctoral thesis that included the basic postulates of generalized theory.

In that same year on the initiative of L. Anatyuk a Department of Thermoelectricity was opened to train specialists in thermoelectricity – the main component of further progress in this scientific and technical line. Annual enrollment to the department is 25-30 persons.

Theoretical investigations at the department continued, and a large number of contractual works were performed for creation of different kinds of thermoelectric equipment. The number of department employees increased to 150.

In 1980 for further development of practical applications of thermoelectricity on the initiative of L. Anatyuk there was opened special design-technological bureau "Phonon" that he headed, keeping charge of Department of Thermoelectricity. In the Design Bureau there were mainly created thermoelectric products for military and space technique.

Within 10 years, as a chief designer, he developed more than 250 thermoelectric products. Among them - thermoelectric coolers for infra-red technique devices and

optoelectronics, satellite communication, gyroscopes, guidance systems; temperature stabilizers of electronic technique products, special air-conditioners; thermoelectric power sources of terrestrial and space purpose, including microsources for special products, using the ambient heat and human heat, high-impact for correction of trajectory in flight, noise-free and latent sources for power supply to radio equipment, space-purpose converters with isotope heat sources; numerous measuring equipment – electromagnetic field sensors; nonselective radiation sensors, most sensitive of existing; alternating current measuring equipment, including standards, laser radiation measuring equipment, devices for quality control of heat exchangers in nuclear reactors, devices for prevention of self-start of destruction means with a nuclear explosion, supersensitive microcalorimeters for determination of bacterial contamination, radiation-resistant pyrometers for finding scattered nuclear fuel during Chernobyl catastrophe and many others.

L.Anatychuk paid special attention to upbringing of initiative and responsible workers. By 1990 the number of personnel in SKTB “Phonon” had reached about 1000 persons. It became the largest and key organization in thermoelectricity.

L.Anatychuk is actively cooperating with the National Academy of Sciences of Ukraine.

As far back as 1982 he took charge of the NAS Ukraine section for thermo- and photoelectric power conversion methods, and in 1986 he was elected associate member of the Academy of Sciences of Ukraine.

In 1990, on the initiative of L.Anatychuk, the SKTB “Phonon” was reorganized into a research Institute of Thermoelectricity of the National Academy of Sciences and Ministry of Education and Sciences of Ukraine. In this way L.Anatychuk paid a tribute to A.F.Ioffe, having revived an academic institute of thermoelectricity, as long as the Institute, created and headed by A.F.Ioffe, in 1972 was undeservedly liquidated by the order of Stalin. Besides, in 2005 by 125<sup>th</sup> anniversary of A. F. Ioffe L.Anatychuk organized International workshop in memory of A.F. Ioffe, in his birthplace, the town of Romny, Sumy region (Ukraine).

In 1993 the pilot industrial base of Institute of Thermoelectricity was separated. The “Altec”Ltd was created on its basis with the purpose of quantity production of Institute developments. L.Anatychuk became scientific supervisor of this organization.

In 2005 for coordination of works there was created scientific-educational-industrial association “RAPID” that included Institute of Thermoelectricity, “Altec”LTD and Chernivtsi University represented by Department of Thermoelectricity.

After the collapse of Soviet Union the Institute obtained favourable conditions for the development of its international activity.

In 1994, on the initiative of L.Anatychuk, International Thermoelectric Academy was created at the International Forum on Thermoelectricity with participation of key scientists from 15 countries worldwide. L.Anatychuk is continually elected President of the Academy. The Academy membership and prestige are constantly growing. Now it includes 78 members from 24 countries worldwide.

In 1995 L.Anatychuk was elected academician of the National Academy of Sciences of Ukraine.

At the Institute, under the scientific supervision of L.Anatychuk, generalized theory of thermoelectricity, thermoelectric material science, optimal control theory for thermoelectric systems, reliability theory, new technologies of thermoelectric materials and devices are under development. Design, development of prototypes and technological documentation for commercialization of different thermoelectric products are developed. Special attention has been focused on the tasks forming progress in thermoelectricity. Unique space products have been created that were installed on nearly 200 Earth satellites for space communication, Earth monitoring, for space platforms, etc. Considerable emphasis was placed on creation of thermoelectric medical equipment for improvement of health and life quality, contrary to military-purpose works performed earlier. In recent years special

attention is paid to “Green technologies”. Theory and technology of vehicular thermal generators was developed. Vehicular generators have been created, they are successfully passing tests. A thermal generator of power 200 kW is being developed that uses waste heat from gas turbines on the main gas pumping stations.

L.Anatyчук has been the organizer of 6 All-Union Schools on thermoelectricity (1974-1992 годы) and 8 International Forums on thermoelectricity (2006-2011).

In 2006 he organized scientific workshop in Como dedicated to discovery of thermoelectricity by Volta.

L.Anatyчук has trained 23 doctors and candidates of sciences. Among them – the worldwide known doctor Bulat L.P., doctor Luste O.J., doctor Vikhor L.N.

### Main lines of research and developments:

- Generalized theory of thermoelectric energy conversion.
- Information-energy theory of measuring systems.
- New thermoelement types.
- Theory of reliability of thermoelectric systems.
- Thermal generators.
- Coolers, thermostats, air-conditioners.
- Theory of functionally graded materials.
- Theory of thermoelectric systems design.
- Thermoelectric material science.
- Measuring technique.
- Computer design of thermoelectric devices and systems.
- Technology of materials and devices.

### Awards for achievements in the work:

#### I. State awards – orders:



1. «THE BADGE OF HONOUR “ 1975



2. THE MEDAL OF OCTOBER REVOLUTION 1986



3. III CLASS ORDER “FOR MERITORIOS SERVICE” 1997



4. II CLASS ORDER “FOR MERITORIOS SERVICE” 2004



5. I CLASS ORDER “FOR MERITORIOS SERVICE” 2007

FULL KNIGHT OF THE ORDER “FOR MERITORIOS SERVICE”

6. The Prize of the USSR Soviet of Ministers – 1987.

## International awards:

1. Honorary Golden Prize of the International Thermoelectric Academy for creation of a generalized theory of thermoelectric energy conversion.
2. “Man of the Year – 2003” title awarded by the American Biographical Institute.
3. Prestigious “World Lifetime Achievement Award” of the American Biographical Institute in 2004.

## Other awards:

1. Republican scholarship in 1945-1950 for a particularly gifted pupil.
2. N.Ostrovsky Republican Prize in science and technology – 1972.
3. All-Union Vavilov Prize “For achievements in measuring technique”.
4. Diploma of the “Astronomical Council of the USSR” for visual detection of Earth satellite breakdown – 1958.
5. Jubilee medal “10 years of Independence of Ukraine” – 2001.
6. Memorial medal of Russian Academy of Sciences “Academician Nikolai Semenovich Kurnakov” – 2003.
7. Distinction of State foundation of basic research “For contribution to science” – 2007.
8. “The academician Keldysh medal of Cosmonautics Federation of Russian Federation - 2007.

## Books:

1. Anatyshuk L.I. Thermoelements and thermoelectric devices. – K.: Naukova Dumka, 1979. – 768 p.
2. Anatyshuk L.I., Luste O.J. Microcalorimetry. – Lviv: Vyscha Shkola, 1981.– 160 p.
3. Anatyshuk L.I., Semenyuk V.A. Optimal control of properties of thermoelectric materials and devices. – Chernivtsi: Prut, 1992. – 264 p.
4. Anatyshuk L.I. Thermoelectricity. Vol. I. Physics of Thermoelectricity. Institute of Thermoelectricity, Kyiv, Chernivtsi, 1998. – 376 p.
5. Anatyshuk L.I., Bulat L.P. Semiconductors under extreme temperature conditions. – Saint-Petersburg.: Nauka, 2001. – 224 p.
6. Anatyshuk L.I. Thermoelectricity. Vol. 2. Thermoelectric power converters. Institute of Thermoelectricity, Kyiv, Chernivtsi, 2003. – 376 p.
7. Anatyshuk L.I. Thermoelectricity. Vol. II. Thermoelectric power converters. Institute of Thermoelectricity, Kyiv, Chernivtsi, 2005. – 348 p.
8. Lukyan Ivanovich Anatyshuk. Dedicated to 70-th anniversary. Institute of Thermoelectricity, Chernivtsi, 2007. – 725 p.
9. Anatyshuk L.I. Thermoelectricity. Vol 1. Physics of Thermoelectricity. Institute of Thermoelectricity, Chernivtsi, 2008. – 388 p.

10. Belles-lettres book of A.Rozhen about Anatyshuk L.I. “Race without finish”, Kyiv: Journal “Raduga”, 2010. – 223 p.

Review of Boris PATON, president of NAS Ukraine:  
*“Captivating story of remarkable scientist! In the past, literature was adorned by good books dedicated to the life of scientists, the importance of their profession. Now it is written little on that. Let us hope that the book by A.Rozhen will mark the beginning of old traditions revival. Young people should have examples worthy of imitation”.*



**Papers\*:** – more than 300 papers

1. L.I. Anatyshuk. Analysis of thermal conductivity of kinetic effects // Chernivtsi National University. – 1958. – P. 4.
2. L.I. Anatyshuk, V.D. Iskra, O.J. Luste, I.M. Rarenko, L.I. Zarubin. Anisotropy of electroconductivity in CdSb // Phys.Stat.Sol. – 1968. – V.27. – P.101-107.
3. L.I. Anatyshuk. Rational areas of investigation and application of Thermoelectricity // Journal of Thermoelectricity. – 1993. – N 1. – P.5-20.
4. L.I. Anatyshuk, O.J. Luste. Modern thermodynamic theory of thermoelectricity // Thermoelectric handbook: macro to nano / Edited by D.M. Rowe. – CRC Press. – 2006. – P. 2-1 – 2-14.
5. L.I. Anatyshuk, L.P. Bulat. Thermoelectric phenomena under large temperature gradients // Thermoelectric handbook: macro to nano / Edited by D.M. Rowe. – CRC Press. – 2006. – P. 3-1 – 3-11.
6. L.I. Anatyshuk, A.A. Pustovalov. Thermoelectric microgenerators with isotope heat sources // Thermoelectric handbook: macro to nano / Edited by D.M. Rowe. – CRC Press. – 2006. – P. 53-1 – 53-17.
7. L.A. Anatyshuk, L.N. Vikhor. Theoretical evaluation of maximum temperature difference in segmented thermoelectric coolers // Applied Thermal Engineering. – 2006. – V.26. – P.1692-1696.
8. Anatyshuk L. I. The Law of Thermoelectric Induction and Extending the Capabilities of Its Application // Journal of Electronic Materials, 2010, Volume 39, Number 9, Pages 1869-1874.
9. L.I. Anatyshuk. Thermoelectric generator for stationary diesel plant // Journal of Electronic Materials, Volume 40, Issue 5 (2011), Pages 1206.

**Patents\*:**

1. L.I. Anatyshuk, O.J. Luste, Thermoelement, Patent UK 1335303, 1971.
2. L.I. Anatyshuk, O.J. Luste, Thermoelement, Patent JP 956899, 1972.
3. L.I. Anatyshuk, V.T. Dimitraschuk, O.J. Luste, Thermoelement, Patent FR 2177129, 1972.
4. L.I. Anatyshuk, V.T. Dimitraschuk, O.J. Luste, Thermoelectric element, Patent UK 1336980, 1973.
5. L.I. Anatyshuk. Patent JP 3500478, 1994.
6. L.I. Anatyshuk. Patent JP 3498222, 1994.
7. L.I. Anatyshuk. Patent JP 3498223, 1994.
8. L.I. Anatyshuk. Patent JP 3498226, 1994.
9. L.I. Anatyshuk, V.Ya. Mykhailovsky, Self-contained thermoelectric generator, Patent for utility model, Ukraine, UA 8637, 2005.
10. L.I. Anatyshuk, V.Ya. Mykhailovsky, L.T. Strutynska, Integrated thermoelectric system of vehicular heat and electricity generation, Patent for utility model, Ukraine, UA 30391, 2008.
11. L.I. Anatyshuk, Thermoelectric vehicular generator with a combined heat removal system, Patent for utility model, Ukraine, UA 41771, 2009.

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\* See full list in the Handbook “[Who is Who in Thermoelectricity](#)”.

### **Presentations at conferences\*:**

1. Pilat I.M., L.I. Anatyshuk Physical properties of some alloys of CdSb-ZnSb system // Ukr.Fiz.Zhurn. – 1963 – V.8, N7. – P.756-761.
2. L.I. Anatyshuk. Generalizations in the Thermoelectric Energy Conversion Models and the Practical Applications // Proc.IX International Conference on Thermoelectrics. – USA. – 1990. – P.346-355.
3. L.I. Anatyshuk, O.J. Luste. Generalized criterion of thermoelectric materials figure of merit // Proc.XI International Conference on Thermoelectrics. – Arlington (USA). – 1992. – P.87-91.
4. L.I. Anatyshuk, L.N. Vikhor, G.A. Ivanov. The optimal control theory for thermoelectric coolers design // Proc. XII International Conference on Thermoelectrics. – Yokohama (Japan). – 1993. – P.412-416.
5. L.I. Anatyshuk, L.N. Vikhor, A.V. Kuznetsov, S.D. Letiuchenko. Functional-gradient materials for thermoelectric energy convertors // Proc.XIV International Conference on Thermoelectrics. – St.Peterburg (Russia). – 1995. – P.7-9.
6. L.I. Anatyshuk. Generalization of faraday law to the process of thermoelectric energy conversion // Proc. V European Workshop on Thermoelectrics. – Pardubice (Czech Republic). – 1999. – P.114-119.
7. L.I. Anatyshuk. New types of thermoelements and possibilities of their application // Proc. VI European Workshop on Thermoelectrics. – Freiburg (Germany). – 2001. – P.5.
8. L.I. Anatyshuk, B.M. Demchuk. Particularly reliable microthermopiles for generators with isotopic heat source based on Pu238 // XXII International Conference on Thermoelectrics. Program and Abstracts. – La Grande Motte (France). – 2003 – P.594-597.
9. L.I. Anatyshuk, J. Stockholm, G. Pastorino. On the discovery of thermoelectricity by A.Volta //Proc. of the VIII ECT2010, Como, Italy, 22.09-24.09.2010.
10. L.I. Anatyshuk, R.V. Kuz'. Computer designing and test results of automotive thermoelectric generator // 2nd Thermoelectric conference «Thermoelectrics goes Automotive», December 9-10, 2010, Berlin.

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