

## For Professor Jan Szargut on his 90<sup>th</sup> birthday

Professor Jan Szargut is a specialist in thermodynamics and thermal engineering. At present he is emeritus professor at the Institute of Thermal Technology at the Silesian University of Technology. Professor Szargut holds a prestigious position of full member of the Polish Academy of Sciences. He is a world-renowned scientist, known especially as a pioneer and expert in the field of exergy analysis.



**Professor Szargut speaking during the Contemporary Problems of Thermal Engineering Conference, Gliwice, Poland – September 2012.**

Professor Jan Szargut was born on September 9, 1923 in Lwow (that time Poland, currently Ukraine). There he spent his young years attending primary and secondary school, and in 1941 he passed his GCSE. In 1942 he became a student in the Faculty of Mechanical Engineering at the Technical University of Lwow, which during the German occupation was named Technische Fachkurse. After the War, in 1946 he moved to Gliwice, as did the whole Lwow Technical University, and he continued his studies at the Technical University of Silesia. He graduated in 1948 and in the same year he was employed as a senior assistant. Between 1951 and 1954 Jan Szargut participated in PhD studies under the supervision of Professor Stanisław Ochęduszeko (who was a former PhD student of Wilhelm Nusselt), and in 1955 he got his Ph.D. degree on the basis of the dissertation on “*Balance equations resulting from the 1<sup>st</sup> and 2<sup>nd</sup> thermodynamic principles*”. In 1957 he became the manager of the Chair of Thermal Engineering. Between 1960 and 1962 Professor Szargut was the Dean of the Faculty of Mechanical and Energy Engineering, Technical University of Silesia. Starting from 1971 Professor Jan Szargut was the director of the Institute of Thermal Technology. He held this position until he retired in 1993. In the year 1976 he was elected a member of the Polish Academy of Sciences. That prestigious position in Polish science has been the crown of his outstanding scientific achievements.

The scientific activities of Prof. Szargut began at the turn of 1940's and 1950's of the last century. At that time he began, as one of the first scientists all over the world, the investigations in the area of exergy analysis of thermal processes. In 1956 Szargut published (in Polish) the work “*Potential balance of physical processes resulting from the second law of thermodynamics*”. This paper closed the early stage of his exergetic adventure that initiated his great contribution to the development of this modern and important branch of thermodynamics – exergy analysis. Within his further works devoted to exergy analysis, Professor Szargut proposed a reference environment for calculating chemical exergy of elements in the Earth. This approach has been one of the most commonly used methods until now and is of great importance from the point of view of the calculation of chemical exergy and is essential for the development of such modern branches of exergy as thermo-ecology and thermo-economics. The research works of Professor Szargut have focused on different applications of exergy for investigations of thermal and metallurgical processes. Additionally, he proposed ecological and economic applications of exergy. The next milestone added by Szargut to the exergy world was the concept of Cumulative Exergy Consumption (CExC). This concept was the base for contemporary branches of advanced exergy analysis – Thermo-Economics and Thermo-Ecology. The latter, also developed by Szargut, is applied for the investigation of the influence of consumption activity of human kind on the depletion of natural resources. So, this application of exergy perfectly supported the idea of sustainability. The great achievements of Szargut's in the field of exergy bore fruits in four monographs on exergy: 1. Szargut J., Petela R. *Exergy*. PWN Warszawa 1965 (in Polish) and Eksergija, Moscow 1968 (in Russian); 2. Szargut J., Moris D. R., Steward F. R., *Exergy Analysis of Thermal, Chemical and Metallurgical Processes*, Hemisphere, New York 1988 (in English); 3. J. Szargut, *Exergy – Technical and Ecological Applications*. WIT Press 2005 (in English); and 4. Szargut, J., *Exergy – Handbook of Calculations and Application*, SUT Press 2007 (in Polish).

The area of Prof. Szargut's scientific activities is not enclosed only within exergy analyses. The early years of his scientific career were simultaneously devoted to the theory of energy balances of chemical processes and the theory of the reference states of chemical enthalpy and exergy. At that time Szargut introduced the concept of the enthalpy of devaluation which was a generalization of lower heating value.

In the 1950's Professor Szargut also began to work on the application of the least squares adjustment method in reconciliations of substance and energy balances in chemical processes. In 1984 he published the monograph "Least Squares Adjustment Method in Thermal Engineering" (in Polish).

During his scientific carrier, Professor Szargut has also published books on the fundamentals of technical thermodynamics, e.g.: "Thermodynamics" (1971 and reissues), "Theory of Thermal Processes" (1973), "Applied Thermodynamics" (1991 and reissues) and "Exercises in Applied Thermodynamics" (1979 and reissues; co-author), "Thermodynamic and Economic Analysis in Industrial Thermal Engineering" (1983), "Fundamentals of Thermal Engineering" (1998 and reissues; co-author). For many years up to now these books have been an invaluable source of knowledge for students learning thermodynamics and thermal engineering at the Silesian University of Technology. For these scientific and didactic activities Szargut is considered to be the creator of the Polish school of thermal engineering and one of the creators of the Silesian school of thermodynamics.

The next important areas of Szargut's scientific interests are mathematical modelling and experimental investigations on heat transfer in metallurgical processes. He worked for example on the mathematical modelling of radiative heat transfer in industrial furnace chambers and heat transfer in recuperators and regenerators. Two books summarized Szargut's investigation in the field of numerical heat transfer: "Numerical Methods in Thermal Calculations of Industrial Furnaces" (1974, in Polish) and "Numerical Modelling of Temperature Fields" (1995, in Polish; co-authored).

In 1993, Professor Szargut officially retired, but he has not given up his scientific activities. After 1993 he was the author, co-author or editor of several books: "Industrial Waste Energy" (1993, in Polish, co-author), "Rationalization of the Consumption of Energy in Industrial Plants" (1994, in Polish, co-author), "Fundamentals of Energy Management" (1995, in Polish, co-author), "Fundamentals of Thermal Engineering" (1998, in Polish, co-author), "Exergy – Technical and Ecological Applications" (2005), "Co-generated heat and electricity production – cogeneration plants" (2007, in Polish, co-author), and "Exergy – Handbook of Calculation and Application" (2007, in Polish).

Professor Szargut has published 327 articles, 24 books and 12 handbooks. At conferences he has presented over 130 papers. Under his guidance 28 PhD theses were prepared; 15 of his PhD students are now professors. He is a member of the editorial board of "Energy – the International Journal", and honorary editor of the "International Journal of Thermodynamics" as well as a member of scientific committees of many prestigious scientific conferences.

For many years Professor Szargut has cooperated closely with industry, particularly metallurgy. Many PhD theses prepared under his guidance dealt with scientific problems in metallurgy. He initiated the construction of recuperators and convection chambers for preliminary preheating of the charge in several Polish ironworks.

Many Phd students supervised by Professor Szargut became well known scientists like for example: Ryszard Petela, Zygmunt Kolenda, Edward Kostowski, Andrzej Ziębik, Joachim Koziół, and others.

Professor Szargut is honoris causa doctor of the Silesian University of Technology, the Częstochowa University of Technology, and Krakow AGH University of Science and Technology. He has been awarded numerous honorary state distinctions and rewards. For all his graduates he will always be an example of straightforwardness and solidity. Professor Szargut is still active as a scientist and creator. As a proof of this thesis two of his recent publications can be quoted: "Energy or Exergy?" (2010, in Polish), "Fuel and Mineral Part of Thermoecological Cost" (2012, in Polish, co-author). This year Professor Szargut has prepared his next work "Comparison between two methods of evaluating chemical exergy" (in Review). – Professor Szargut is still realising his scientific and research passion. Closing this tribute we all would like to wish Professor Szargut many years of good health that would allow him to continue the inspiring story of a Great Scientist.

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