

PEOPLE OF SOVIET SCIENCE

SAMSON SEMENOVICH KUTATELADZE

(ON HIS 60th BIRTHDAY)

Editorial Board



July 18, 1974 was the 60th birthday of a great thermophysics scientist, Director of the Institute of Thermophysics, Siberian Branch of the Academy of Sciences of the USSR, Corresponding Member of the Academy of Sciences of the USSR, Professor, and Doctor of Technical Sciences, Samson Semenovich Kutateladze.

For a quarter of a century, with a four-year military break, the scientific activity of Samson Semenovich Kutateladze was connected with the I. Polzunov Central Boiler and Turbine Institute where he followed a course from student-trainee (1931) to Professor and department head (1959).

Samson Semenovich's first work attracted the attention of the scientific community by the original and bold approach to complex problems and the deep physical intuition of the author. In 1935 he proposed a system for calculating turbulent free-convective flows based on the separation of the flow into zones of laminar flow near the wall and of an outer turbulent jet. These results were confirmed experimentally in the USSR and the USA only at the end of the 1960s. Then followed a cycle of research into processes of heat exchange during phase transitions. The young investigator examined the conditions of similarity of heat exchange and hydrodynamics upon a change in the aggregate state of a substance and introduced a fundamental criterion (the ratio of the latent heat of evaporation to the heat of the phase transition) which reflects the specific properties of heat exchange during any physicochemical conversion. Extensive experimental research on heat exchange during vapor condensation, boiling, and the freezing of liquids were generalized in the monograph "Principles of the theory of heat exchange during a change in the aggregate state of a substance" (1939). The ideas formulated by the author obtained universal recognition and substantially determined the development of a new direction in the theory of heat exchange.

The Great Patriotic War interrupted the scientific activity of S. S. Kutateladze. From June 1941 to August 1945 Samson Semenovich was in sections of the Northern Front and the 14th Army of the Karelian Front. After demobilization he again returned to the Central Boiler and Turbine Institute. In 1950

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S. S. Kutateladze defended his Candidate's dissertation and in 1952 his Doctoral, and he became a Professor in 1954.

One of S. S. Kutateladze's most outstanding achievements was the explanation of the mechanism of the boiling crisis. In 1949 Samson Semenovich suggested that the start of film boiling should be considered as a special hydrodynamic crisis developing when the vapor formed at a heating surface completely suspends the masses of liquid adjoining the surface and separates them from the surface of the heater. The available experimental data were explained well by the dependence for the critical heat flux which was proposed on the basis of this approach.

The principle of flow analysis from the point of view of hydrodynamic stability made it possible to subsequently determine the conditions of existence of different modes of flow of gas-liquid mixtures. The results of theoretical and experimental studies of gas-liquid mixtures were generalized by S. S. Kutateladze and M. A. Styrikovich in the monograph "Hydraulics of gas-liquid systems" (1958).

S. S. Kutateladze took active part in work connected with the development of Soviet nuclear energy. A series of theoretical and experimental works on the study of the heat transfer and hydrodynamics of the movement of liquid metals in tubes and channels was carried out under his guidance. In 1958 on the basis of these studies S. S. Kutateladze along with a collective of authors wrote a monograph on liquid-metal coolants.

In 1950-1957 the hydrodynamics of the flow of one-phase liquids began to occupy an important place in the scientific research of Samson Semenovich. It was in these years that he constructed averaged equations for the motion of turbulent flows of a compressible gas and calculated the heat transfer during flow in tubes under essentially nonisothermal conditions.

Samson Semenovich continued work on the theory of turbulent boundary flows, one of the most difficult fields in modern hydrodynamics, at the Siberian Branch of the Academy of Sciences of the USSR where he was invited in 1959 to the post of assistant to the director of the Institute of Thermophysics. Here in 1959 he discovered the existence of a finite value of the relative coefficient of friction with an unlimited increase in the Reynolds number. This permitted the formulation of relative limiting laws of friction and heat exchange in turbulent boundary layers and an examination of the application of these laws.

The theory of the turbulent boundary layer of a liquid with a vanishing viscosity served as a basis for systematic experimental studies of fundamental problems of turbulent transport and permitted the discovery of simple calculating equations.

Work based on the hypothesis of the degeneration of the thermal boundary layer which builds up at an adiabatic surface must also be placed here. The asymptotic theory of thermogasdynamic curtains arose by virtue of this hypothesis. This theory, developed on the basis of relative limiting laws of friction and heat exchange, made it possible to create the calculating methods which are generalized in the monograph "The turbulent boundary layer of a compressible gas" and in the monograph "Boundary turbulence."

Since 1965 Samson Semenovich has devoted much attention to the hydrodynamics of non-Newtonian liquids and especially to the phenomenon of the reduction of hydrodynamic resistance with small additions of compounds of high molecular weight to water. A series of experimental works confirmed the hypothesis that the effect of the reduction of hydrodynamic resistance which develops is connected with a decrease in the intensity of transverse velocity pulsations in a considerable part of the boundary layer.

At the Siberian Branch of the Academy of Sciences of the USSR Samson Semenovich continued work on the hydrodynamics of two-phase flows. Studies on the investigation of the mechanism of boiling of liquid metals were carried out under his guidance using methods of x-ray visualization. The phenomenon of the development of the film mode of boiling following the mode of free convection, omitting the stage of bubble boiling, was studied. An electrodiffusion diagnostic method was developed for gas-liquid flows, making it possible to obtain comprehensive information on the flow structure.

Samson Semenovich has written 12 monographs and more than 200 articles in all. His books have been reissued more than once in the Soviet Union and many of them have been translated and published in the USA, England, and Czechoslovakia.

In 1965 S. S. Kutateladze was chosen as Director of the Institute of Thermophysics of the Siberian Branch, Academy of Sciences of the USSR. A scientific-industrial society with a thermophysics direction

was created under his guidance (the Institute of Thermophysics, SKB Énergokhimmash).

In 1963 S. S. Kutateladze and L. M. Rozenfel'd proposed the use of a binary cycle containing coolants for the development of electrical energy and the only practical geothermal electric station containing a freon turbo-generator in the world was created on this basis.

In 1968 Samson Semenovich was elected as a Corresponding Member of the Academy of Sciences of the USSR. His working activity and great scientific services have been recognized with many government awards: the Order of Lenin, the Order of the Red Banner of Labor, the Badge of Honor, and medals.

S. S. Kutateladze's scientific activity is always associated with pedagogical activity. For almost 10 years he has headed the Department of Thermophysics of Novosibirsk State University. Many of his students have defended doctoral and candidate's dissertations. The Siberian Thermophysics Seminar created on the initiative of Samson Semenovich has acquired nationwide importance. Results in the fields of turbulence theory, physical hydrodynamics, heat exchange during phase transitions, and energetics are discussed here every year.

S. S. Kutateladze is a member of the editorial boards of the Journal of Applied Mechanics and Technical Physics and of High Temperature and a member of the editorial council of the Journal of Engineering Physics.

Samson Semenovich has repeatedly represented Soviet science abroad at international congresses and conferences. He is Vice President of the National Committee of the Academy of Sciences of the USSR on Heat and Mass Exchange, a member of the Assembly of International Conferences on Heat Exchange, the Scientific Council of the International Center on Heat and Mass Exchange, and a member of the honorary editorial council of the International Journal on Heat and Mass Exchange. The scientific work of S. S. Kutateladze has received international recognition: in 1970 at the International Conference on Heat-Transfer for his outstanding achievements in the field of heat exchange he was awarded the International Max Jacob Medal established by the American Society of Mechanical Engineers and the American Institute of Chemical Engineers.

For service in the development of science and the preparation of scientific cadres and in connection with his 60th birthday Samson Semenovich Kutateladze was awarded the Order of the October Revolution.

The Editorial Board of the Journal of Engineering Physics warmly congratulates Samson Semenovich Kutateladze on the glorious jubilee and wishes him fine health and further creative successes for the good of the Soviet Motherland.