THE FIFTH ALL-UNION CONFERENCE ON HEAT AND MASS TRANSFER, MAY 17-20, 1976, MINSK

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The organizers of this conference were the State Committee of the Council of Ministers of the USSR on Science and Technology (Scientific Council on Heat and Mass Transport in Technological Processes), the Academy of Sciences of the USSR (Division of Technical-Physics Problems in Power Engineering), the National Committee on Heat and Mass Transfer, the Scientific Council on Theoretical Aspects of Chemical Technology, the Academies of Sciences of the Belorussian SSR, Ukrainian SSR, Latvian SSR, and Lithuanian SSR; the Ministry of Higher and Intermediate Specialized Education of the USSR, and the Committee of the All-Union Drying Research Society.

The following forms of organization were used:

1. All the conference materials (abstracts, papers, and communications) were reproduced and sent out for preliminary familiarization to all participants.

2. The sections dealt with topical and survey papers by leading specialists on current aspects of heat and mass transfer, with discussions on the presented papers.

3. Leading specialists gave lectures on current topics in heat and mass transfer.

This style provided scope for discussing all the major problems, as well as general topics. Five conferences have thus been held on this basis, and these have shown that this style is highly successful.

The conference program included 476 papers and communications, of which 92 were from abroad, which included the following:

1) Section No. 1: Convective heat and mass transfer – 104 papers and communications, with 24 of these from abroad;

2) Section No. 2: Heat and mass transfer in chemically reacting systems – 28 papers and communications, with 3 from abroad;

3) Section No. 3: Heat and mass transfer in phase transitions – 86 papers and communications, with 22 from abroad;

4) Section No. 4: Heat and mass transfer in two-phase flows – 35 papers and communications, with 6 from abroad;

5) Section No. 5: Heat and mass transfer in porous media – 37 papers and communications, with 4 from abroad;

6) Section No. 6: Heat and mass transfer in dispersed systems – 39 papers and communications, with 7 from abroad;

7) Section No. 7: Heat and mass transfer in rheologically complex systems – 35 papers and communications, with 8 from abroad;

8) Section No. 8: Heat transfer by radiation and combined heat transfer – 39 papers and communications, with 7 from abroad;

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9) Section No. 9: Theory of thermal conduction – 48 papers and communications, with 6 from abroad;

10) Section No. 10: Research and measurement methods in heat and mass transfer – 25 papers and communications, with 5 from abroad.

The material presented for the congress constituted 227 printer's sheets. Further, the conference program (2.5 printer's sheets) was published in an edition of 1200.

Since the Fourth All-Union Conference on this topic (1962), various major research and pilot-plant studies have been performed, which in part formed the subject of the lively discussion at the sections. These involved not only individual particular topics but also some of the major general topics in heat and mass transfer.

In all, 224 participants were involved in the discussions.

The discussions on the papers and communications were accompanied by two open discussions on the following topics: performance of modern methods of turbulent heat-transfer calculation (8 participants, apart from the reporter) and heat-transfer crises in boiling in pipes (13 participants).

An innovation at the Fifth Conference was the use of a lecture hall, in which leading specialists in heat and mass transfer gave 13 lectures. It was generally considered that such lectures should form a feature of future conferences.

The Fifth Conference aroused considerable interest in this country and abroad; the 1144 engineering and scientific participants included 107 from 16 other countries.

Many of the requests for participation had to be refused on the basis of the existing conference statutes. The latter feature was reflected in the conference resolution, which emphasized the need for a future conference.

The participants included 14 Academicians and Corresponding Members of the Academy of Sciences of the USSR and the Republican academies, 138 Doctors of Science, and 452 Candidates. Technical colleges were represented by 336 delegates, research organizations by 625; and design offices, production organizations, and plants by 76.

The following resolution was adopted: the 25th Congress of the Communist Party of the Soviet Union has confirmed a grandiose program for development of the national economy; considerable importance in improving the efficiency and quality of social production must be attached to research in heat and mass transfer, which should result in new technological processes and equipment.

Since the Fourth Conference, various major research works have been performed on heat and mass transfer, which have been of fundamental and applied types. Particular note should be made of research on the theory of convective heat transfer between a wall and a liquid subject to additional conditions (turbulence, nonstationary injection, flow detachment, effects of mass forces). There have also been advances in heat transfer in boundary layers and also in turbulent heat transfer, particularly as regards statistical characteristics. In addition, there has been considerable extension of studies on jet flows and wakes with natural convection and with combinations of forced convection and gravitational convection.

Much research has been performed on heat and mass transfer during combustion, in reacting boundary layers, ablation, dissociating heat carriers, and chemical deposition.

New general relationships have been derived for heat-transfer rates and crises for various liquids in free motion. The conditions resulting in crises have been examined, together with the thermodynamic characteristics of various major devices, including boiler tubes.

Efficient designs of heat-transfer equipment of spiral-flow type have been developed and examined and also styles with colliding jets, falling layers of granular materials, and other types designed to accelerate the processes.

Detailed researches on physical transport mechanisms have provided better mathematical models for heat and mass transfer in porous media, as well as new highly efficient processes and equipments for controlling heat and mass transfer in soils, building materials, petroleum processing, drying generally, sublimation, and condensation.

Theoretical and experimental studies have been performed on hydrodynamics and heat-transfer phenomena in fluidized systems, and a jet theory of fluidization has been formulated.

Major principles have been developed for the theory of convective heat-transfer processes in nonlinear viscoplastic media; the electrorheological and magnetorheological effects have been examined. In addition, the effects from polymer additives have been utilized in controlling momentum and heat- and mass-transfer rates.

Further advances have been made in computation methods for heat transfer by radiation and by several mechanisms jointly.

Also, greatly increased attention has been given to research methods and to means of measuring heat- and mass-transfer characteristics.

The conference emphasized the need for improved coordination between research on heat and mass transfer; in particular, coordination in this area is required between the Scientific Councils of the Academy of Sciences of the USSR on heat physics and on the theoretical principles of chemical technology, as well as with the Scientific Council of the State Commission of the Council of Ministers of the USSR on Science and Technology concerned with mass and heat transfer in technological processes.

The discussions led the participants to emphasize the following major lines of research in heat and mass transfer.

1. Further research is required on turbulent flow and heat transfer, with particular emphasis on the internal structures of turbulent flows under varying physical conditions, in the presence of mass forces, and also when there is radiative heat transfer or chemical reaction.

2. Research on heat and mass transfer in chemically reacting systems should be extended with proper allowance for reaction kinetics, heat transfer by radiation and convection, and special effects from turbulent flow.

3. Research should be extended on nonstationary processes, particularly as regards emergency and transient states, with research on the thermohydraulic characteristics of pipes of complex shape, studies on special processes in solutions and mixtures and on effects at the surfaces of various structures.

4. The scale of research on heat and mass transfer in two-phase flows should be extended, particularly for systems designed to intensify transfer (film flow, spiral flows, colliding jets, bubble devices). Particular attention should be given to nonlinear transport laws (acoustics, magnetic interaction, pulsations, and so on).

5. Macroscopic descriptions of heat- and mass-transfer processes should be accompanied by research on the behavior of porous media considered as heterogeneous multiphase systems at the microscopic level, with proper allowance for surface phenomena in the presence of external fields. Molecular-kinetic and thermodynamic methods should be used in such research.

6. Research on the hydrodynamics and heat-transfer features of granular systems should be extended in order to define efficient methods of controlling corresponding equipment. Some effort should also be directed to the design of boiler systems employing low-temperature combustion of solid fuel in fluidized-bed form.

7. Extensive effort is required, with improved instrumentation, in rheology; and routine production of rheoviscometers should be instituted in order to determine the elastoviscoplastic characteristics of polymer systems and dispersed systems generally. Further research is needed also on electrorheology and magnetorheology in order to provide a basis for highly efficient heat- and mass-transfer equipment.

8. Further advances are required in the theory of complex combined heat-transfer processes, together with experimental researches on classical heat-engineering devices as well as new ones, particularly those working at cryogenic temperatures.

9. Research should be extended on thermophysical processes related to practical use of superconductivity.

10. Computer-assisted methods should be developed for capturing, processing, and analyzing data to provide objective recommendations on computerized methods. Every effort should be made to extend the range of physical phenomena employed in measurement planning in heat- and mass-transfer research.

11. The range of thermophysical research should be extended, particularly to biology and medicine, in order to provide means of diagnosis from heat radiation, as well as control of metabolic processes.

12. There should be an ongoing service of forecasting type for progress in heat- and mass-transfer science and technology.

The conference also welcomed the appearance of a new issue of the heat and mass transfer abstracting journal Teplomassoobmen, which corresponds to the latest requirements for publications of this type.

The conference considered the following measures as necessary.

1. More rapid utilization of research results in industry in order to create advance processes and equipment that improve labor productivity and product quality.

2. The teaching of heat and mass transfer to students in technological specialities should be extended by introducing courses on mathematical simulation.

3. The lectures and problem-oriented reports read at the conference should be published, as well as the discussion materials.

4. A conference on heat and mass transfer should be held in 1980; research organizations should also hold narrower conferences and symposia on the above scientific topics in heat and mass transfer.

The conference thanked the organizing committee for its considerable labors and also the secretaries of the sections who were responsible for its success.

THE SECOND INTERNATIONAL CONFERENCE ON HEAT PIPES

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This conference was held from March 31 to April 2, 1976, in Bologna (Italy); it was organized by the Institute of Technical Physics at Bologna University jointly with the Italian National Council, and with the support of Euratom, the American Institute of Astronautics and Aeronautics, and the European Space Research Organization. The conference was attended by about 100 participants from 10 countries.

The conference was preceded by a meeting of the International Scientific Committee, at which it was suggested that the Third International Conference should be held in the fall of 1978. The papers were published as a collection before the conference opened (79 papers). There were 17 papers from the USSR.

The conference operated in 13 sections (low-temperature heat pipes, liquid-metal heat pipes, heat pipes in gravitational fields, heat-pipe dynamics, variable-resistance heat pipes, centrifugal heat pipes, problems in material compatibility, heat transfer in evaporation and boiling in porous structures, use of heat pipes on the ground and in space, etc.).

The number of papers at 79 was much larger than that at the first conference (44; conference held in October, 1973), which indicates substantial advances in the utilization of heat pipes in various branches of engineering.

There has lately been a substantial technical revolution in accelerating heat transfer by means of such heat pipes; devices of this type are comparable with lasers as regards the extent of their applications.

About one-third of the papers were concerned with the theory of energy and matter transport in such heat pipes, research on heat transfer during boiling, particularly for porous structures; liquid transport in capillaries, hydrodynamics of vapor flow, and interactions with liquids. The other two-thirds of the papers dealt with material compatibility, uses of heat pipes in technology, and space applications.

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