

## P R E F A C E

The 7th International Heat Pipe Conference was held on May 21-25, 1990 in Minsk, at the A.V. Luikov Heat & Mass Transfer Institute Byelorussian Academy of Sciences. Such conferences have been organized and held since 1973 by the International Committee on Heat Pipes chaired by Dr. George Grover, the inventor of heat pipes. Since 1990 the chairman of this International Committee is Prof. Dr. Manfred Groll.

The heat pipe is one of the remarkable achievements of thermal physics and heat transfer engineering in the 20th century. Heat pipes are unique in their capability to transfer heat over large distances without considerable losses, because their thermal resistance is negligibly small and independent of their dimensions and shape.

The heat pipe may be used as a symbol of heat and mass transfer, because this outwardly simple heat-exchanging device embodies most processes of fluid dynamics and heat transfer (conduction, phase transitions, convection, radiation, kinetics, dynamics and heat transfer of the rarefied gas, etc.). The heat pipe operates on the basis of a closed-cycle process of mass and heat transfer that involves phase changes (vaporization, condensation) and can take place over a wide range of temperature and pressure on intricately shaped surfaces of complex structure and in channels of varying geometry and random spatial orientation.

The circulation is caused by a pressure gradient proportional to the temperature gradient. The flow carries energy which is transferred from the hot to the cold end of the heat pipe, or the heat is converted into other forms of energy (electric, luminous, mechanical, etc.). The heat pipe combines the achievements of present-day science and engineering because it may be designed using modern technology in every aspect of its operation.

That is why hundreds of heat pipes and thermosyphons of

varying design, from a few millimeters to several kilometers in length, are employed in industry and agriculture to transfer heat from fractions of watt to hundreds of kilowatts over temperature range from tenths degrees of K ( superfluid helium ) to 2000 K . Thousands of patents have been issued and filed for heat pipes.

The main applications of heat pipes deal with the problems of environmental protection and energy and fuel saving. Heat pipes provide increased heat transfer rates in machines and reactors, cooling of modern electronic equipment, computers, machine tools, chemical and biological integrated systems, and large-scale reduction of harmful emissions from industrial plants. In agriculture, heat pipes can provide optimum climatic conditions for animals and plants, and improved storage conditions for agricultural products.

In the context of commercialization of space, heat pipes are used to improve the methods of producing ultrapure materials, to forecast atmospheric conditions, to develop research equipment, etc.

Heat pipes are used to good advantage in the construction and operation of oil and gas pipes, roads, and dams in the northern areas of the U.S.S.R., the U.S.A. and Canada. Heat pipes are employed to freeze and cool the soil during construction work, to strengthen the earth beds for highways, to regulate subsoil erosion, heaving, and other negative phenomena, occurring in the soil due to disturbed temperature and moisture conditions, to heat up roads, bridges, over- and under passes in order to control icing, snow-drifts, etc.

The Proceedings of the 7th International Heat Pipes Conference will undoubtedly be of interest because of the possible use of heat pipes in new recuperative and regenerative heat exchangers whose operating parameters compare favorably with those of traditional design, make them highly reliable and efficient in operation, and make it possible to keep the heat transfer surface at a constant temperature.

The main purpose of such heat exchangers is to utilize heat recovery systems, particularly those at low potentials.

It is common knowledge that with about 2 billion metric tons of standard fuel consumed annually in the U.S.S.R., the wasted

energy resources account over 350 million kW.

Much of this energy source is at a low potential (below 250 °C), i. e. , in the course of fuel-consumption, the production processes discharge wasted energy resources to the environment at low temperatures .

The 7th International Heat Pipes Conference was attended by more then 200 scientists and experts from 19 countries: 155 papers and 5 lectures were presented to the conference; an International Heat Pipes Exhibition was held during the conference. The International Heat Pipes Conferences have a long history of many years, but it was for the first time that 15 institutions from the U.S.S.R. displayed their products.

Considering the recent increase of interest in the problems of energy consuming , space exploration and nature protection , four sections were set up within the conference to deal with the fundamental problems of heat and mass transfer, technological problems, and also the application of heat pipes in industry and agriculture.

The 7th IHPC Proceedings include the most interesting papers approved by the Chairmen of the sessions and Rapporteurs.

Among the interesting features of these Proceedings are not only the results of new studies on heat pipes, but also lectures on the general problems of heat and mass transfer , the problems of energy and fuel conservation , environmental protection and peaceful space exploration .

I hope that the publication of the 7th IHPC Proceedings will provide a deeper insight into the new problems and contribute to the rational utilization of the latest advances in science and technology for the welfare of mankind.

It is a great pleasure to take this opportunity to express my appreciation to the Sponsoring institutions, members of Committee on International Heat Pipe Conferences, to the authors of papers and lectures, Chairmen and Rapporteurs and members of the Local Organizing Committee of the 7th International Heat Pipe Conference for their cooperation and help.

Leonard L. Vasiliev

Editor, Proceedings of the 7th International Heat Pipe Conference.