

Thermophysical Properties Data: Government–University–Industry Cooperation in Multidisciplinary Research¹

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Historical developments regarding the realization of the importance of reliable thermophysical properties data in engineering applications are presented. The events leading to the establishment of the Symposium on Thermophysical Properties in 1959 and the accomplishments of the symposia series since then are discussed. Contributions of the National Bureau of Standards to the thermophysical properties field are described.

KEY WORDS: history of Symposia on Thermophysical Properties; history of thermophysical properties.

1. SOME HISTORICAL COMMENTS

The interest of the American Society of Mechanical Engineers (ASME) in reliable thermophysical data goes back essentially to the founding of the society and has its roots in the philosophy of two of its founders, A. L. Holley and R. H. Thurston, whose "... program for American technological pre-eminence involved both the use of a rigorous method to acquire precise data and a technical institution for the conversion of engineering science into industrial practice" [1].

Consistent with this philosophy, in June of 1921 a New York Edison Company engineer, Mr. George A. Orrok, arranged a meeting of some university researchers, government personnel, and representatives of the electric utility industry to see what could be done to obtain reliable data on the thermodynamic properties of steam [2]. This meeting resulted in an

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international effort that spanned almost two decades and resulted in the acquisition of excellent data on the properties of water not only in the vapor phase, but also as liquid and solid, including both thermodynamic properties and transport properties. The required research was carried out in the United States both at universities (mainly MIT and Harvard) and at the National Bureau of Standards (NBS), with funding both by the government and by private industry. The total program was international in scope, with significant contributions from many European countries, particularly Germany and Great Britain. The steam research program brought together researchers from many disciplines, including mechanical engineers, chemical engineers, chemists, and physicists. The names of many distinguished scientists and engineers became associated with that program, such as P. W. Bridgman, F. G. Keyes, S. C. Collins, H. N. Davis, R. V. Kleinschmidt, N. S. Osborne, H. F. Stimson, E. F. Fioch, and D. C. Ginnings.

When then main part of the steam research program was completed in the late thirties, there still remained great gaps of knowledge for most of the other substances. It was to fill these gaps that the Heat Transfer Division of the ASME set up its Committee K-7, the Standing Committee on Thermophysical Properties. This Committee continued many of the traditions of the steam research program, including the close cooperation between the ASME and the NBS, the joint effort of government, universities, and industry, the multidisciplinary approach, and the emphasis on international cooperation.

2. THE SYMPOSIA ON THERMOPHYSICAL PROPERTIES

The Committee on Thermophysical Properties had organized sessions at ASME national meeting in 1947, 1953, and 1955. A fourth session had been planned for the 1958 Winter Annual Meeting. However, the response to the call for papers was so great that the papers simply could not be covered in one session and could not be accommodated in the already crowded Winter Annual Meeting. The chairman of the committee, Yeram S. Touloukian, decided to organize a separate symposium, so that all the papers of sufficient quality could be presented. Thus, the first of this series of symposia was held on February 23–26, 1959, at Purdue University. It included 42 papers covering a broad range of topics. Seven of the papers were from three foreign countries. That first symposium was so successful that the committee recommended (and the ASME approved) holding such symposia regularly, at about 3-year intervals.

I had the pleasure of serving on the organizing committees of the first four symposia and of chairing the third, which was held at Purdue Univer-

sity on March 22–25, 1965. I would like to quote a few statements from the Foreword of the proceedings of that symposium.

The ... philosophy (was) to gather together papers representing the most advanced aspects of research on thermophysical properties, and to endeavor to achieve a balance between experimental and theoretical approaches, and in particular to collect representative contributions from the many disciplines involved in the study of thermodynamic and transport properties. ... Accordingly (the symposium included) a number of papers on high temperature properties of refractory metals and of other high temperature materials; (it included) new data on properties of molten metals and of metal vapors of interest in nuclear power, thermionic devices, and fuel cells; also there (was) an increased number of papers on new experimental techniques. The continuing need for more accurate and sophisticated theories (was) well documented by a number of important papers on statistical mechanics and molecular physics [3].

The growth of the symposia in the intervening years has been quite impressive. This ninth symposium includes nearly 200 papers. The international character of the symposium is even stronger: over 80 papers have been contributed by authors from 22 foreign countries! It is a pleasure for me to recognize among the authors the familiar names of some of the contributors to the first few symposia. It is reassuring to see that those old-timers have been joined by a host of new researchers.

3. THE ROLE OF THE NBS

These remarks would be incomplete without some comments on the impressive contributions made in this area by the NBS. Continuing a tradition that dates back to its establishment in 1901, the bureau has an impressive record of thoroughness, accuracy, and reliability in the acquisition of precise physical and chemical data. Its splendid record of accomplishments includes the very valuable work of validation of data as part of the Standard Reference Data System. In this important undertaking, the Office of Standard Reference Data utilizes not only the bureau's own facilities, but also those of industry and of several academic institutions. The office plays a particularly important role in influencing the work of several learned societies, such as the American Society of Metals, the American Ceramic Society, and the Society of Plastics Engineers. These three societies, with cooperation from the NBS, are collecting and evaluating critically data on phase diagrams on alloys, ceramic materials, and polymeric blends, respectively.

The NBS contributions to the knowledge of thermophysical properties are by no means limited to the very important work of the Office of Standard Reference Data. Significant experimental and theoretical contributions are being made by other offices of the National Measurement Laboratory,

as well as by the National Engineering Laboratory and by the Center for Materials Science. Special mention should be made of the Center for Chemical Engineering, of which Dr. H. J. M. Hanley, the chairman of this symposium, is a member. A measure of the contributions of the NBS in this field is given by the 30 papers contributed to this symposium by NBS personnel!

4. CLOSURE

In closing, I would like to congratulate the ASME for its continuing support of this important activity, the NBS for its important role, and all the authors for their valuable contributions. The work presented at this symposium is of critical importance not just to science, but also to technological progress. Good engineering requires precise data, supported by valid theoretical principles.

REFERENCES

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