

## FOREWORD

Among the structural materials that have been put to use for man's benefit in the last century a noticeable place is occupied by alloys based on titanium. Being discovered by William Gregor as far back as at the end of the 18th century, this metal has formed the basis for the structural materials without which one cannot conceive the present-day civilization. The range of semifinished articles from these alloys includes all of the variants of geometries and dimensions needed to manufacture structural elements of greatest utility.

Achievements in industrial application of any material depend to a large extent (if not entirely) on the availability of information on its properties. Moreover, many of the technologies and fields of application require the knowledge of the characteristics of the metal not only in the temperature region of its application but also of its production.

While coping with their first metals — tin, copper, gold, and finally, iron, people comprehended the role of "fire," the role of the heating and cooling parameters, on which the characteristics of an articles depend — be it a peasant's spade or a warrior's sword. It is this important role of "fire" in application to titanium that the present books is devoted to. The way in which temperature influences

the properties of titanium and of the alloys based on it runs all through the material presented in the book.

Up to now, information on the properties of the majority of materials in a solid and a liquid states has mainly come from specially staged experiments, with each being subjected to its own uncontrolled effects that distort the result observed. It is only the comparison of the results obtained by various researchers that allows one to come nearer to elucidating the true picture of the phenomenon studied and to the true value characterized by a numerical estimate. It is for this reason that the book has been based on the analysis of the world-wide published results that were accessible to the authors.

This book brings to the reader's attention the accumulated information on the thermophysical properties of titanium and its main alloys. The term "thermophysical properties" encompasses the range of phenomena that reflect the response of the metal to various effects especially under the conditions of a varying temperature. The book has comprised systematized information that will allow an engineer to carry out computation of the processes of heating and cooling of titanium materials, to estimate the fields of temperatures, deformations, and stresses, and to evaluate the possibility of application of titanium and materials (alloys) based on it in order to devise new structures and technological processes.

Expertise and analysis of the results of experimental investigations presuppose the competence based on the personal experience of such an activity. For many years the authors of this treatise have been active researchers of the thermophysical properties of various substances. For example, we can mention the monograph "Thermophysical Properties of Molybdenum and Its Alloys" (Metallurgiya Press, Moscow, 1990) prepared by them based on their investigations of this refractory metal. As attested by the bibliography appended to the book, they have also dealt with titanium materials. What's more, in cooperation with their colleagues they prepared the handbook "Thermophysical Properties of Titanium and of its Alloys" which was published in the USSR by Metallurgiya Press in 1985.

As to the subject-matter, the present work is closely related to the above-named book, but taking into account the experience accumulated by the authors and the new data that appeared in the publications of recent years, this is by essence a new work. The authors hope that the material compiled will be of use for engineers and scientists. The former will find here the needed numerical data, the latter will see once again that there is a great quantity of experimentally revealed facts which lack theoretical interpretation as yet.

The fulfillment of such a work is impossible without support from those who head scientific-research centers. The authors deem it necessary to express their

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The Authors