

## SYMPOSIUM ON TITANIUM

## INTRODUCTION

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Aside from uranium, probably no metal in the past decade has so captured the interest of the metallurgical industry as titanium. It is a good metal, with a combination of availability, lightness with strength, and corrosion resistance that makes it of particular interest to the aeronautical industry. This interest, with support from the Department of Defense, has resulted in phenomenal progress in the commercial and technical development of this relatively new metal of construction. In fact, titanium has been a worthy leader in the recent rise of a whole series of little known metals to a position of considerable commercial importance.

As with all metals, titanium has shortcomings. Its rise in importance and usefulness has not been smooth. It has been necessary to explore many physical and mechanical properties to find how best titanium and its alloys can fit into the family of useful structural materials. This caution in practical application has been augmented by the relatively high cost of titanium which has tended to limit applications to those that can tolerate a substantial premium cost for unusual performance. Fortunately, the scale of production has been rising and the prices of both metal sponge and mill

products have been falling rather rapidly. Thus, it is expected that titanium can gradually assume a wider base of applications as the cost handicap becomes a smaller factor. There is little doubt that titanium is here to stay and will become an increasingly important material.

The growth in the technology of titanium has been accompanied by an awareness of the special problems involved in testing, in control of operations, and in evaluating many properties. As with so many of the comparatively high-melting metals, titanium not only alloys with many metals and metalloids but its properties are strongly influenced by carbon, oxygen, nitrogen, and hydrogen. One of the biggest handicaps in the early years of working with reasonably pure, ductile titanium was to regard it as being similar to stainless steel. The precautions needed in working and using titanium now are becoming generally understood, and significant methods of testing are evolving.

High interest and the exceptional rate of progress in working out the technology of titanium has resulted in an amazing number of technical papers, symposia, and special meetings or conferences to cover this progress. Apparently in recent years one sure way to assure a successful meeting has been to include a session on titanium. Because of this excellent coverage by other societies ASTM has hesitated to organize technical sessions

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devoted to titanium until a real need existed. Such a need was shown first by interest in specifications. A task group was promptly formed in Subcommittee VIII of ASTM Committee B-2 on Non-Ferrous Metals and Alloys, which gradually evolved the present ASTM Specifications for Titanium Sponge (B 299 - 55 T) and for Titanium Strip, Sheet, Plate, Bar, Tube, Rod, and Wire (B 265 - 52 T). Likewise, Methods for Chemical Analysis of Titanium and Titanium-Base Alloys (E 120 - 56 T) was evolved through ASTM Committee E-3 in Chemical Analysis of Metals. As problems arose showing the need for good technical information on which to base specifications, it appeared desirable to encourage technical papers along testing and property evaluation lines. This, of course, is a field in which ASTM should take leadership.

The present Symposium on Titanium was organized late in 1955 as plans for the Second Pacific Area National Meet-

ing were being formulated. Since the Pacific area is a leader in the aeronautical industry which has special interest in titanium, it has seemed particularly fitting to hold such a symposium in Los Angeles. The symposium has been sponsored directly by Committee B-2 on Non-Ferrous Metals and Alloys. The Administrative Committee on Research has given encouragement and aid as an indirect sponsor. Although a number of papers submitted for this meeting have not dealt directly with test procedures or properties, they have been included to make a program of wide interest.

Much of the work of organizing this symposium has been carried in a very capable manner by James R. Long, the Symposium Chairman. To him and to Tom Lippert, Chairman of the ASTM Task Group on Titanium, and to Earle Schumacher, Chairman of Subcommittee VIII of Committee B-2, all who have been connected with this endeavor are greatly indebted.