this is a new concept, but its validity cannot be evaluated because no supporting data or references are given.

A major surprise is the report that vacuum annealing of commercially pure and alpha titanium alloys renders them subject to notch-impact embrittlement over a period of years, presumably as a result of absorption of hydrogen from water vapor at room temperature on the active titanium surface resulting from vacuum annealing. This implies that a clean titanium surface can reduce water vapor at room temperature. No Western information supports this startling report. A great deal of vacuum-annealed commercial titanium is being produced in the United States for use in chemical equipment. One may be sure that there will be some scurrying around our titanium plants to find some well-aged material on which to check the Russian report. I am inclined to discount the validity of the report because a titanium dioxide film forms rapidly on titanium surfaces, and after a short time there should be little difference between a vacuum-annealed or non vacuum-annealed surface. The book does not cover the more recently discovered effect that cooling alpha titanium through the hydride precipitation field under stress results in hydride platelets precipitating normal to the applied tensile stresses. Hydride precipitated in such a way is more embrittling than the normal random precipitation.

There are few comments that one can make about a book like **Phase Diagrams of Titanium Alloys** (Israel Program for Scientific Translations, Jerusalem; Davey, New York, 1965. 318 pp., $15.25), by E. K. Molchanova, except to say whether or not it provides a complete and accurate summary of the available literature in a readily accessible form. Molchanova's book, which was translated from the second Russian edition by A. Halbreich, N. Kaner, and M. Statter and which is an updating of the book by Molchanova and Glazunov (1954), does not appear to do this very well, although the information on constitution is supplemented by data on metastable phases formed in heat treatment, and includes ternary alloy systems as well as binary. The data on the constitution of alloys is brought up to 1962, the same period covered by R. P. Elliott's recent supplement to the classic *Constitution of Binary Alloys* by Hansen and Anderko, which brought the binary phase diagram literature up to 1956 and 1957. The Defense Metals Information Center at Battelle Institute's Columbus laboratories brought the literature on binary and ternary titanium phase diagrams up to September 1960.

The situation on titanium phase diagrams is in a muddle as a result of controversy over the constitution of the titanium-aluminum (Ti-Al) system, where a sluggish ordered phase forms in the terminal hcp alpha-phase field. Aluminum is the most important alloying element in titanium alloys, and is a constituent in most commercial alloys. Thus, information about the existence of the ordered phase in alpha titanium is crucial to a good understanding of the metallurgy of titanium alloys. It was disappointing, therefore, to find inadequate and superficial coverage of the controversial Ti-Al system in Molchanova's book where only passing reference is made to the subject. The 1956 diagram of Sagel, Schulz, and Zwicker is presented, with only citations to the more recent work.

In addition to information on constitution, the book gives data on the mechanical properties, some physical properties (resistivity), and chemical properties (oxidation). This is certainly desirable. I checked a number of well-known cases, and it appears that important American references on mechanical properties have been overlooked or disregarded. The phase diagrams are grouped according to type of diagram rather than in a useful alphabetical arrangement. This may be appealing scientifically, but it makes the book much more difficult to use as a reference source.

Despite its limitations, the phase diagram book contains very useful information and, along with *Hydrogen in Titanium*, deserves a place in the library of engineers and scientists who are concerned with titanium metallurgy.

R. I. JAFFEE

Metal Science Group,
Battelle Memorial Institute,
Columbus, Ohio 43201

Ichthyology

The first four parts of this monumental work, *Fishes of the Western North Atlantic*, were reviewed in *Science* on 7 May 1965 (*Science* **148**, p. 834). This fifth part, **Order Iniomi, Order Lyomeri** (Sears Foundation for Marine Research, Yale University, New Haven, Conn., 1966. 662 pp., $27.50), contains accounts of two major groups of soft-rayed fishes of the area extending from Hudson Bay to the Amazon and from the mid-Atlantic east of Bermuda to the estuaries of the coastal plain.

Most of the volume is devoted to the order Iniomi, a group of offshore species known mainly by ichthyologists, except for the lizard fish and allied species found along the tropic and temperate coasts.

The order Lyomeri, which is discussed in the final portion of the book, is a small group of bizarre deep-sea creatures of extraordinary form. The major part of the volume is the work of the editor-in chief, Giles W. Mead; the other portions were prepared by nine collaborating ichthyologists: William W. Anderson, Frederick H. Berry, James E. Bohlke, Rolf L. Bolin, Jack W. Gehringer, Robert H. Gibbs, Jr., William A. Gosline, N. B. Marshall, Robert Rofen, and Norman J. Wilimovsky. Parts 6, 7, and 8 will be published in future years to complete the work.

HILARY DEASON

AAAS

New Books

Mathematics, Physical Sciences, and Engineering

Accélérateurs Circulaires de Particules: Introduction à la Théorie. Henri Bruck. Institut Natl. des Sciences et Techniques Nucléaires, Saclay; Presses Universitaires de France, Paris, 1966. 370 pp. Illus.

Advances in Programming and Non-Numerical Computation. L. Fox, Ed. Pergamon, New York, 1966. 226 pp. Illus. $10. Nine papers given at the 1963 Summer School, Oxford University: "Introduction to automatic computing" by S. Gill; "List programming" by P. M. Woodward; "Programming" by D. W. Barron and C. Strachey; "Artificial languages" by J. M. Foster; "Aλ-calculus approach" by P. J. Landin; "A survey of non-numerical applications" by S. Gill; "Theorem-proving in computers" by D. C. Cooper; "Game-playing and game-learning automata" by D. Michie; and "Information retrieval and some cognate computing problems" by R. M. Needham.

The Analytical Chemistry of the Noble Metals. F. E. Beamish. Pergamon, New York, 1966. 623 pp. Illus. $18.50. International Series of Monographs in Analytical Chemistry, vol. 24.

(*Continued on page 1301*)