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Book Reviews

Hydrostatic Extrusion: Theory and Applications. Edited by N. Inoue and M. Nishihara, Elsevier Applied Science Publishers, London and New York, 1985. 378 pp. $66.00.

REVIEWED BY SEROPE KALPAKJIAN[1]

Although the use of hydrostatic pressure in metalworking operations was first suggested almost a century ago, major interest in the subject did not develop until the late 1950s following the work of P. W. Bridgman in the U.S., H.Ll.D. Pugh in the U.K., L. R. Vereshchagin in the U.S.S.R., and M. Nishihara in Japan. Since then there have been a large number of papers published and conferences held on this subject, but only one book in English has been published (J. M. Alexander and B. Lengyel, *Hydrostatic Extrusion*, Mills and Boon, London, 1971). The present volume is a collection of several articles by 12 authors (nine Japanese, two U.S. and one U.K.). Four of the authors are from universities and eight from industry. Edited by N. Inoue (Science University of Tokyo) and M. Nishihara (Kobe Steel Ltd.), the book presents the progress made in all aspects of hydrostatic extrusion to date and, according to the editors, is written to provide a useful introduction to the subject for practicing engineers.

The book is divided into six chapters, most with several sections written by various authors. The introductory chapter (N. Inoue) is a good outline of the present state of knowledge on hydrostatic extrusion and includes key references to the subject. It points out the fact that, at the early stages of development, the process was used mainly for brittle materials presumably to take advantage of the beneficial effect of hydrostatic pressure on the ductility of metals. However, ductile metals were the first to be produced commercially, such as copper tubing. The operation was essentially a batch process, but a variety of techniques for continuous operation were soon developed. The process has been successfully applied to clad products, fine wire, and various specialized shapes.

In Chapter 2, K. Osakada, P. B. Mellor, W. R. D. Wilson, and T. Matsushita cover the fundamentals of the process, including theoretical treatments of the mechanics of hydrostatic extrusion and lubrication. It is pointed out that in this process friction at the die-billet interface is low and, hence, lower die angles and higher extrusion ratios can be employed compared to other extrusion processes. This situation leads to higher hydrostatic stresses in the deformation zone – conditions which suppress fracture. The basic process, its characteristics and capabilities, the important parameters involved, and type of products obtained are described in Chapter 3 by S. Mitsugi and M. Seido. Hot extrusion, using wax, greases or polymers as the pressure-transmitting medium, is described in Chapter 4 by M. Nishihara. Chapter 5 (M. Yamaguchi, Y. Yamaguchi, A. Kobayashi) describes in detail the tooling, presses, and various auxiliary equipment used in industrial plants, particularly at Kobe Steel, Ltd. and Hitachi Cable, Ltd. The final chapter (M. Seido, S. Mitsugi, R. J. Fiorentino, K. Osakada, N. Inoue) deals with specialized applications such as clad composite metals, special alloys, fine wires, and polymers.

The book is comprehensive in its coverage of all aspects of the subject with a good balance of theory and applications. It has numerous illustrations with a great deal of experimental data, the statements are well documented, and the references are complete and up to date. Although, as expected, the individual chapters and sections written by various authors introduce some redundancy and lack of coherence to the text, the authors have indeed succeeded in providing a good introduction to the theory and practice of hydrostatic extrusion.

The enthusiastic approach to the subject matter throughout the text is somewhat tempered by the statement of the editors (and a well-known fact) that, in spite of the considerable knowledge that exists in hydrostatic extrusion and its demonstrated capabilities, many manufacturers still hesitate to adopt this technology in their plants. The editors attribute this reluctance to the general lack of information on the process and the equipment involved, and unfamiliarity with the actual method of operation. It would have been interesting to have some input from several manufacturers, in the form of a brief chapter, as to what their thoughts were regarding this aspect and how they viewed the economics of hydrostatic extrusion vis-a-vis its unique capabilities.

Nevertheless, this book is a significant contribution to the technical literature in metalworking and should be of great use to those interested in the principles as well as the applications of hydrostatic extrusion.

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Tribophysics, by N. P. Suh, (1SBNO-12-930983-7), Prentice Hall, Inc. Englewood Cliffs, N.J. 07632.

REVIEWED BY M. C. SHAW[1]

This is a research monograph that should be a valuable addition to the library of all concerned with the friction and wear of metals and polymers. The book is divided into nine chapters that conveniently bring together in one place the many contributions of Professor Suh and his students.

Chapter one (Introduction) discusses the origins of friction and wear, the characterization of surfaces relative to topography and the organization of the remainder of the book. It should be noted that the historical definition of the nondimensional coefficient K (Archard, 1953) is adopted where

$$K = 3VH/LS$$

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