

## BOOK REVIEWS

### CERAMIC COMPONENTS FOR ENGINES

Proceedings First International Symposium 1983, Japan

Editors: Shigeyuki Sominya, Eizo Kanai, Kan-ichiro Ando

Publishers: Elsevier Applied Science, London and New York, 1986, 812 pp. £75.00

The First International Symposium was held in 1983 and these papers were previously published by KTK Scientific Publishers, Tokyo in 1984. The present volume, published in 1986 presents 78 papers.

The first part of this collection gives the progress made in National projects for developing automobile ceramics. H. Okuda reviews Japanese projects and progress. W. Bunk gives a detailed overview of W. German programmes while A.F. McLean gives an overview of worldwide research. A NASA viewpoint is given by H.P. Probst.

Approximately 40 papers are next given on Silicon Nitride research, and 10 papers on Silicon Carbide. A further group of papers centers on materials based on stabilised Zirconia. Finally, papers are presented dealing with different aspects of processing.

The interest in  $\text{Si}_3\text{N}_4$  and SiC can be taken as an indication of the potential of these materials to withstand the thermal environment in some of the engine applications studied, but for an adiabatic engine, R. Kamo suggests that these materials might not have the desired expansion coefficient properties. In the context of engine manufacture, monolithic ceramics and ceramic coatings are described. The latter are considered as thermal barriers and energy absorbing layers. The protection of airfoils against impact is discussed.

In processing, some guide lines are laid down for process selection, including low cost production. The processing routes described cover many techniques including reactive sintering for fused mullite and  $\text{ZrO}_2$  powders, pressureless sintering of silicon nitride ceramics, HIP, injection moulding, sol-gel processing, hydrothermal processes and high pressure hot pressing. Testing procedures on materials include long term static and low cycle fatigue, three point loading. Durability tests on engines and components are described.

The reissue of this book may be taken as an indication of the importance of the papers presented. An extensive amount of tabulated data is given. The illustrations of processes are excellent and the quality of the electron micrographs is very good.

## PLASMA, ELECTRON AND LASER BEAM TECHNOLOGY

Y. Arata

Publishers: American Society for Metals, 1986, 630 pp. £85.00

The American Society for Metals has published the collected papers of Professor Yoshiaki Arata of Osaka University, on technology involving high energy density beams. Modern heat processing technology uses these sources for energy densities up to 1000 kW/cm<sup>2</sup>. They are employed in a broad and diverse range of operations including extractive processes, melting, refining, cutting, joining, surface modification. Important applications have been made to ceramics, composites, high temperature materials, VLSI devices etc.

The book presents 57 papers, based on research, or giving overviews of important points of theory, of equipment, or of industrial applications. Many of the papers present pioneering research covering the period 1973 until 1985. They are collected under 5 chapter headings. The first chapter reprints two papers dating from 1985 giving overviews of the theory of electron, plasma and laser beams, accompanied by schematic lay-outs of equipment used in welding processes with these sources. Chapter 2 reprints eleven papers describing the physics of these sources. In Chapter 3, studies are described of the beams, commencing with Professor Arata's method for evaluating beam characteristics. Beam shape is discussed together with focusing. The theory of moving heat sources is presented and analysis is made of the weld penetration of high energy density beams. Different types of plasma apparatus are described in detail which include magnetic controls and variation in gas supply.

The final two chapters deal with technological applications. These chapters are mainly devoted to welding and cutting and describe metals and ceramics. Evaluation is made of electron beam welding of high tensile strength construction steels, laser cutting of mild steel, laser cutting of stainless steel. The final papers cover laser hardening of steel, laser nitriding of Titanium, and plasma spraying of ceramic coatings on steel.

All the papers are excellently illustrated and a section of colour plates is included. This book is an important reference source for engineers engaged in the processing of materials, and for students of materials and of engineering.

## **MATERIALS FOR REFRACTORIES AND CERAMICS**

### **A Study of Patents and Patent Applications**

**Editor: Marten Terpstra**

**Elsevier Applied Science Publishers London and New York 1986, 282pp. Price £40.00**

This book presents a literature survey covering British, French, German and European (Munich) patents published since 1976. The study was compiled for the Commission of European Communities and gives descriptions of approximately 1,000 patents initiated by R. and D. Depts. of U.S., Japanese and W. European companies. The applications are listed alphabetically at the back of the book. The dates for the patents roughly cover the period 1976-81. The items covered include raw materials, finished products for electronic and electrical apparatus, gas turbines, machine tools and industrial equipment. A section is included on equipment patents for producing refractories.

Amongst the raw materials covered in the first part of the book are aluminium oxide, silicon carbide, silicon nitride, boron nitride. Patents are also described for catalysts, e.g. in the preparation of hydrocarbons and in the preparation of zeolites.

The book makes interesting reading and the presentation of information is accompanied by clear illustrations.