

CERAMIC SURFACES AND SURFACE TREATMENTS

Edited by

R. MORRELL

*Division of Materials Applications
National Physical Laboratory*

and

M. G. NICHOLAS

*Atomic Energy Research Establishment
Harwell*



BRITISH CERAMIC PROCEEDINGS

No. 34

AUGUST 1984

Published by The British Ceramic Society
Shelton, Stoke-on-Trent, Staffs. U.K.

RW 439
(34)

Contents

Page

INTRODUCTORY PAPER

1. Computer Simulation of Ceramic Surfaces and Interfaces 1
P.W. Tasker and A.M. Stoneham (Atomic Energy Research Establishment, Harwell)

SURFACE ANALYTICAL TECHNIQUES APPLIED TO CERAMICS

- 2.* Methods of Surface Analysis-XPS, AES and SIMS- and Their Application to Ceramics 19
A.B. Christie (Loughborough Consultants Ltd., University of Technology, Loughborough)
3. An ESCA Study of the Visual Effects of Chemical Durability in Enamels for Glass Tableware 21
R.J.S. Young, E.G. Rowlands (Johnson Matthey Research Centre, Reading) and S.A. Smith (University of Bath)
4. Application of AES and XPS for Microstructural Characterization of Dense Si_3N_4 and Oxynitride Glasses 31
W. Braue, H.J. Dudek, G. Ziegler (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Köln, F.R. Germany.)
5. Spectroscopic Investigations of Metal-Ceramic Enamel Interface 45
A. Stoch, J. Stoch and C. Paluszkiwics (Institute for Mining and Materials, Krakow, Poland)
6. Investigations of Oxygen Surface Exchange Kinetics on Oxide Surfaces Using Dynamic SIMS 53
B.C.H. Steele, J.A. Kilner, P. Dennis and D. Tamhauser (Wolfson Unit for Solid State Ionics, Department of Metallurgy and Materials Science, Imperial College, London)

SURFACES AND MECHANICAL PROPERTIES

7. Modifying the Tribological Properties of Ceramics by Ion Implantation 65
P.J. Burnett and T.F. Page (Department of Metallurgy and Materials Science, University of Cambridge)

| | | |
|------|---|-----|
| 8. | Ion Beam Sputter Modification of Alumina Surface Morphology <i>Z.W. Kowalski (Institute for Electronic Technology, Technical University of Wrocław, Poland)</i> | 77 |
| 9. | Determination of Surface Stresses of High Temperature Ceramic Materials <i>R. Prümmer and H.W. Pfeiffer-Vollmar (Fraunhofer-Institut für Werkstoffmechanik, Freiburg, F.R. Germany)</i> | 89 |
| 10. | Surface Stresses in Modified BaTiO ₃ Ceramics <i>G. de With and J.E.D. Parren (Philips Research Labs., Eindhoven, The Netherlands)</i> | 99 |
| 11.* | Effect of Surface Oxidation Flushing of Sintered Silicon Nitride on Strength <i>A. Tsuge (Metals and Ceramics Lab., Toshiba Research and Development Centre, Kawasaki City, Japan)</i> | 109 |
| | HARDNESS AND WEAR | |
| 12.* | Wear of Ceramic Surfaces <i>T.F. Page (Department of Metallurgy and Materials Science, University of Cambridge)</i> | 111 |
| 13. | The Hardness of Alumina Ceramics <i>D.J. Clinton and R. Morrell (National Physical Laboratory, Teddington, Middlesex)</i> | 113 |
| 14. | Friction at Broad and Narrow Contacts Between Silicon Nitride and Hardened Steel <i>H. Fessler (University of Nottingham) and D.C. Fricker (Howmedica International Inc., Limerick)</i> | 129 |
| 15. | A Problem in Assessing the Wear Behaviour of Ceramics: load, temperature and environmental sensitivity of indentation hardness <i>J.T. Czermuska and T.F. Page (Department of Metallurgy and Materials Science, University of Cambridge)</i> | 145 |

| | | |
|------|--|-----|
| | SURFACE REACTIONS | |
| 16. | Surface Stabilization of Yttria-Containing Tetragonal Zirconia Polycrystals (Y-TZP) <i>H. Schubert, N. Claussen and M. Rühle (Max-Planck-Institut für Metallforschung, Stuttgart, F.R. Germany)</i> | 157 |
| 17.* | Dealkalization of Glass Surfaces by SO ₂ and SO ₃ <i>W.C. LaCourse and J.M. Diaz (Alfred University, Alfred, New York, U.S.A.)</i> | 161 |
| 18. | Some Effects of Surface Texture on Melt-Mould Interactions During Investment Casting <i>M.G. Nicholas, R.M. Crispin (Atomic Energy Research Establishment, Harwell) and D.A. Ford (Rolls Royce Ltd, Filton, Bristol).</i> | 163 |
| | CERAMIC COATINGS | |
| 19.* | Use of Ceramics to Control the Physical and Chemical Properties of Surfaces <i>J.A. Cairns, J.L. Woodhead and D.L. Segal (Atomic Energy Research Establishment, Harwell, Didcot, Oxon)</i> | 173 |
| 20. | Ceramic Coatings by CVD <i>C. Hayman (Fulmer Research Ltd., Slough, Bucks.)</i> | 175 |
| 21. | Hard and Wear Resistant Coatings by Chemical Vapour Deposition <i>N.J. Archer (Archer Technicoat Ltd., High Wycombe, Bucks.)</i> | 187 |
| 22. | Plasma-Sprayed Ceramic Coatings <i>K.T. Scott (Atomic Energy Research Establishment, Harwell, Didcot, Oxon.)</i> | 195 |
| 23. | Rolls-Royce Experience with Thermal Barrier Coatings <i>A. Bennett (Rolls Royce Ltd., Derby)</i> | 207 |
| | JOINING OF CERAMICS | |
| 24. | Glass-Ceramic Bonds to Metals <i>G. Partridge and C.A. Elyard (GEC Power Engineering Ltd., Stafford Labs., Stafford)</i> | 219 |
| 25. | Joining REFEL Silicon Carbide to Porcelain <i>L.A. Lay, R. Morrell (National Physical Laboratory, Teddington, Middx.) and R. Wallis (Crane Packing Ltd., Slough, Bucks.)</i> | 231 |

| | | |
|------|--|-----|
| 26. | Interfacial Reactions Between SiC and Al During Joining <i>T. Iseki, T. Maruyama (Research Laboratory for Nuclear Reactors, Tokyo Institute of Technology, Ohokayama, Japan) and T. Kameda (Toshiba Corp., Yokohama, Japan)</i> | 241 |
| 27. | Ceramic and Metal Surfaces in Ceramic-to-Metal Bonding <i>J.T. Klomp (Philips Research Laboratories, Eindhoven, The Netherlands)</i> | 249 |
| 28. | Surface Reaction Between Nickel and Alumina at High Temperatures <i>M.G. Gee (National Physical Laboratory, Teddington, Middlesex)</i> | 261 |
| 29. | High Pressure Bonding of Ceramics to Metals <i>K. Suganuma, T. Okamoto, M. Koizumi (Institute of Scientific and Industrial Research, Osaka University, Japan) and M. Shimada (Department of Technology, Tohoku University, Sendai, Japan)</i> | 273 |
| 30.* | The Diffusion Bonding of Ceramics <i>E.R. Wallach (Dept. of Metallurgy and Materials Science, University of Cambridge)</i> | 287 |
| | Index | 289 |
| | * Abstract only | |