

CONTENTS

POWDER AND PRECURSOR PREPARATION BY SOLUTION TECHNIQUES

1.1	Introduction	1
1.2	Powder Characterization	3
1.3	Precursor Powder Synthesis	8
1.4	Summary	23

POWDER PREPARATION BY GAS-PHASE TECHNIQUES

2.1	Introduction	29
2.2	Powder Production by Thermal Decomposition Techniques	30
2.3	Powder Production by Plasma Techniques	35
2.4	Powder Production by Supercritical Fluid Techniques	37
2.5	Powder Characterization	39
2.6	Summary	40

FORMATION OF CERAMIC FILMS AND COATINGS

3.1	Introduction	43
3.2	Film Deposition and Coating Processes	44
3.3	Physical Characterization	47
3.4	Chemical Characterization	50
3.5	Mechanical Characterization	57
3.6	Summary	60

CONSOLIDATION OF CERAMIC THICK FILMS

4.1	Introduction	63
4.2	Thick Film Processing	64
4.3	Characterization of Ceramic Thick Film Consolidation	65
4.4	Summary	75

CONSILIDATION OF BULK CERAMICS

5.1	Introduction	77
5.2	Ceramic Consolidation	78
5.3	Characterization of Ceramics	82
5.4	Summary	96

INORGANIC GLASSES AND-CERAMICS

6.1	Introduction	103
6.2	Possible Surface Analytical Artifacts	104
6.3	XPS Studies of Bonding in Glass	108
6.4	Corrosion in Water	110
6.5	Glass Crystallization	114

CERAMIC MICROSTRUCTURES

7.1	Introduction	119
7.2	Bulk Microstructural Features	120
7.3	Interfaces and Planar Defects	124
7.4	Dislocations	127
7.5	Methods of Phase Identification	129
7.6	Stereology for Phase Quantification	133
7.7	Summary	135

CERAMIC REACTIONS AND PHASE BEHAVIOR

8.1	Introduction	137
8.2	Starting Materials	140
8.3	Phase Equilibria	140
8.4	Rates and Mechanisms of Reaction	156
8.5	Summary	166

MECHANICAL PROPERTIES AND FRACTURE

9.1	Introduction	169
9.2	The Fracture Process	169
9.3	Generation of Fracture Surface Features	174
9.4	Procedures and Equipment Used in Fractography	181
9.5	Applications of Fractography	182

CERAMIC COMPOSITES

10.1	Introduction	189
10.2	Mechanical Properties of Ceramic Composites	191
10.3	Oxidation Resistance of Ceramic Composites	202
10.4	Electrical Properties of Ceramic Composites	204
10.5	Summary	206

GLASS AND CERAMIC JOINTS

11.1	Introduction	211
11.2	Characterization of Interfaces	212
11.3	Methods of Joining	213
11.4	Fundamentals of Interfacial Bonding: Wetting and Spreading	216
11.5	Reactive Metal Brazing of Aluminum Nitride	219
11.6	Summary	225

ELECTRONIC AND MAGNETIC CERAMICS

12.1	Introduction	229
12.2	Insulators and Capacitor Materials	230
12.3	Piezoelectrics	234
12.4	Pyroelectric Ceramics	236
12.5	Ferroelectric Ceramics	237
12.6	Ceramic Superconductors	238
12.7	Ferrites	239
12.8	Ceramic Sensors	241
12.9	Ceramic Thin Films	242

NONDESTRUCTIVE EVALUATION

13.1	Introduction	253
13.2	X-ray Techniques	255
13.3	Ultrasonic Techniques	257
13.4	Other Techniques	261
13.5	Summary	264

APPENDIXES: TECHNIQUES SUMMARIES

1	Auger Electron Spectroscopy (AES)	269
2	Electron Energy-Loss Spectroscopy in the Transmission Electron Microscope(EELS)	270
3	Electron Probe X-Ray Microanalysis (EPMA)	271
4	Energy-Dispersive X-Ray Spectroscopy (EDS)	272
5	Fourier Transform Infrared Spectroscopy (FTIR)	273
6	Light Microscopy	274
7	Neutron Diffraction	275