

Contents

Preface — V

List of contributing authors — XI

Nathalie Godin, Pascal Reynaud, Mohamed R'Mili, and Gilbert Fantozzi

1 Mechanical behavior of ceramic matrix composite (CMCs) and lifetime prediction by acoustic emission — 1

- 1.1 Introduction — 1
- 1.2 Acoustic emission: Analysis and methodology — 3
 - 1.2.1 Location of the AE signal — 3
 - 1.2.2 Relevant descriptors — 4
 - 1.2.3 Clustering of the AE signal — 6
 - 1.2.4 Recorded AE energy vs source energy — 8
 - 1.2.5 Identification of attenuation parameters — 8
 - 1.2.6 Coefficient of emission R_{AE} — 9
 - 1.2.7 Power law — 9
- 1.3 Results during mechanical tests — 10
 - 1.3.1 Monotonic tensile behavior — 10
 - 1.3.2 Static fatigue at intermediate temperature — 14
 - 1.3.3 Cyclic fatigue at high temperature — 26
- 1.4 Conclusion — 31

Ajay Kaushal and José Maria da Fonte Ferreira

2 Advanced electroceramic composites: Property control through processing — 39

- 2.1 Introduction — 39
- 2.2 Experimental details — 41
 - 2.2.1 Synthesis of BZT–BCT ceramics through an aqueous colloidal processing route — 41
 - 2.2.2 Structural characterization of sintered BZT–BCT ceramic samples — 42
 - 2.2.3 Mechanical characterization of sintered BZT–BCT ceramic samples — 43
 - 2.2.4 Electrical characterization of sintered BZT–BCT ceramic samples — 43
- 2.3 Results and discussion — 43
 - 2.3.1 Structural properties — 43
 - 2.3.2 Mechanical properties — 49
 - 2.3.3 Electrical properties — 51
- 2.4 Conclusions — 56

Yongsheng Zhang, Junjie Song, Yuan Fang, Hengzhong Fan, and Litian Hu

3 Regulation and control of macro-micro structure for optimal performance in alumina self-lubricated composites — 59

- 3.1 Introduction — 59
- 3.2 Influence of structure parameters on the mechanical properties of the alumina laminated composites — 60
- 3.3 Influence of structure parameters on the tribological properties of laminates — 65
- 3.4 Design of interfaces for optimal performance of alumina laminated composites — 69

Dariusz M. Jarzabek and Wojciech Dera

4 The measurement of mechanical properties of interfaces in ceramic composites — 77

- 4.1 Introduction — 77
 - 4.1.1 The role of the interface — 77
 - 4.1.2 The basics of fracture theory — 78
- 4.2 The nanoindentation techniques — 81
 - 4.2.1 Short introduction to nanoindentation — 81
 - 4.2.2 Pushing out a fiber — 82
 - 4.2.3 Indentation tests of thin films — 83
 - 4.2.4 Compression of micropillar test specimen — 86
 - 4.2.5 Conclusion — 87
- 4.3 Pull-out and microbond tests — 88
- 4.4 Tensile tests — 90
 - 4.4.1 Interfacial shear strength measurement — 90
 - 4.4.2 Interfacial tensile strength measurement — 91
- 4.5 Scratch test — 96
 - 4.5.1 Conventional scratch test — 96
 - 4.5.2 The precracked line scratch test — 97
 - 4.5.3 Microdot scratch test — 97
- 4.6 Application of scanning force microscope in the interface strength determination — 99
 - 4.6.1 Short introduction to atomic force microscopy — 99
 - 4.6.2 Interface strength determination with nanopillars — 101
- 4.7 Concluding Remarks — 104

Brahim Aïssa and Mohamed Bououdina

5 Carbonaceous nanomaterials for hybrid organic photovoltaic application — 109

- 5.1 Introduction — 109
- 5.2 Carbon nanotubes in photovoltaic — 111

- 5.3 Graphene in photovoltaics — 116
- 5.4 Carbon nanotubes/graphene hybrid for solar cell application — 120
- 5.5 Outlook and perspectives — 121

Brahim Aïssa

- 6 **Advances in self-healing based on carbon nanomaterials for electrical circuits – A review — 127**
 - 6.1 Introduction — 127
 - 6.2 State of the art — 127
 - 6.3 Conclusions — 140

Index — 143