

Contents

Processing and Fracture Mechanics of Multiscale Nacre-like Composites

- 1. Introduction1
 - 1.1. Goals and organization of the thesis1
 - 1.2. Context4
 - 1.3. Bio-inspiration from Nacreous Biological Composites6
 - 1.4. Mechanical Properties of Nacre and the Hypotheses on its
Structure-Property Relationships8
 - 1.5. Strategies for Nacre-like Model Composite and the Approach
for Extracting Design Principles16
 - 1.5.1. Stiffness and Strength.....16
 - 1.5.2. Fracture Toughness19
 - 1.5.3. Extracting Design Principles.....22
 - 1.5.4. Acknowledgements.....22

1.6. References	23
2. Mineral Nano-interconnectivity Stiffens and Toughens Nacre-like Composite Materials	29
2.1. Introduction	31
2.2. Materials and Methods	35
2.2.1. Composite Fabrication	35
2.2.2. Characterization	36
2.3. Results and discussion	37
2.4. Conclusions	51
2.5. Acknowledgements	52
2.6. References	53
3. Quantifying the Role of Mineral Bridges on the Fracture Resistance of Nacre-like composites	60
3.1. Introduction	62
3.2. Materials and Methods	68
3.2.1. Composite Fabrication	68
3.2.2. Characterization	69

3.3. Results and Discussion	71
3.4. Conclusions	93
3.5. Acknowledgements	94
3.6. References	95
4. Hierarchical Toughening of Nacre-like Composites	102
4.1. Introduction	104
4.2. Materials and Methods	109
4.2.1. Composite Fabrication	109
4.2.2. Characterization	110
4.3. Results and Discussion	111
4.4. Conclusions	129
4.5. Acknowledgements	130
4.6. References	131
5. Conclusions	140
6. Outlook	146
7. Appendix A	149
8. Appendix B	154

Contents

9. Appendix C.....	163
10. Curriculum vitae	173