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Mechanics of Bioinspired Lamellar Structured Ceramic/Polymer Composites: Experiments and Models

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1 **Abstract**

2 Creation of super-tough ceramics is one of the main goals of materials
3 science. Bioinspired design is shown to be the most effective method to
4 achieve this goal. Previous studies on the mechanical performance of biolog-
5 ical multilayered materials such as nacre have shown that their outstanding
6 mechanical properties are direct results of the small-scale features and opti-
7 mized arrangement of the elements in their microstructure. Hence, the freeze
8 casting technique has been recently introduced as a novel method to create a
9 new class of bioinspired polymer/ceramic composites. However, the method
10 is cumbersome and the mechanics that controls the overall performance of
11 these composites is not well-known. In this study, the mechanical perfor-
12 mance of bioinspired alumina /polydimethylsiloxane ($\text{Al}_2\text{O}_3/\text{PDMS}$) and alu-
13 mina/polyurethane ($\text{Al}_2\text{O}_3/\text{PU}$) composite samples with lamellar structure

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