

Accepted Manuscript

Full length article

A comparative study of bio-inspired protective scales using 3D printing and mechanical testing

Roberto Martini, Yanis Balit, Francois Barthelat

PII: S1742-7061(17)30187-3

DOI: <http://dx.doi.org/10.1016/j.actbio.2017.03.025>

Reference: ACTBIO 4793

To appear in: *Acta Biomaterialia*

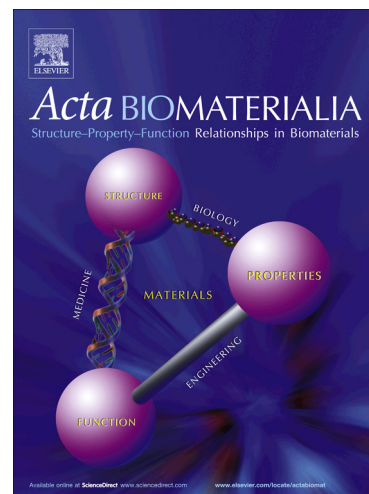
Received Date: 13 December 2016

Revised Date: 15 February 2017

Accepted Date: 14 March 2017

Please cite this article as: Martini, R., Balit, Y., Barthelat, F., A comparative study of bio-inspired protective scales using 3D printing and mechanical testing, *Acta Biomaterialia* (2017), doi: <http://dx.doi.org/10.1016/j.actbio.2017.03.025>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



A comparative study of bio-inspired protective scales using 3D printing and mechanical testing

Roberto Martini, Yanis Balit and Francois Barthelat*

Department of Mechanical Engineering, McGill University, 817 Sherbrooke Street West,
Montreal, QC H3A 2K6, Canada

*Corresponding author: francois.barthelat@mcgill.ca

Abstract.

Flexible natural armors from fish, alligators or armadillo are attracting an increasing amount of attention for their unique combinations of hardness, flexibility and light weight. The extreme contrast of stiffness between hard scales and surrounding soft tissues gives rise to unusual and attractive mechanisms, which now serve as models for the design of bio-inspired armors. Despite this growing interest, there is little guideline for the choice of materials, optimum thickness, size, shape and arrangement for the protective scales. In this work, we explore how the geometry and arrangement of hard scales can be tailored to promote scale-scale interactions. We use 3D printing to fabricate arrays of scales with increasingly complex geometries and arrangements, from simple squares with no overlap to complex ganoid-scales with overlaps and interlocking features. We performed puncture tests and flexural tests on each of the 3D printed materials, and we report the puncture resistance – compliance characteristics of each design on an Ashby chart. The interactions between the scales can significantly increase the resistance to puncture, and these interactions can be maximized by tuning the geometry and arrangement of the scales. Interestingly, the designs that offer the best combinations of puncture resistance and flexural compliance are similar to the geometry and arrangement of natural teleost and ganoid scales,

Download English Version:

<https://daneshyari.com/en/article/6449256>

Download Persian Version:

<https://daneshyari.com/article/6449256>

[Daneshyari.com](https://daneshyari.com)