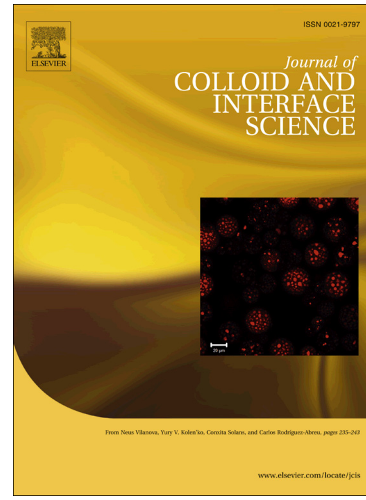
Accepted Manuscript



Modeling and optimization of shark-inspired riblet geometries for low drag applications

Samuel Martin, Bharat Bhushan

PII: S0021-9797(16)30239-9
DOI: http://dx.doi.org/10.1016/j.jcis.2016.04.019
Reference: YJCIS 21209

To appear in: *Journal of Colloid and Interface Science*

Received Date: 29 March 2016
Accepted Date: 13 April 2016

Please cite this article as: S. Martin, B. Bhushan, Modeling and optimization of shark-inspired riblet geometries for low drag applications, *Journal of Colloid and Interface Science* (2016), doi: http://dx.doi.org/10.1016/j.jcis.2016.04.019

Modeling and optimization of shark-inspired riblet geometries for low drag applications

Samuel Martin and Bharat Bhushan[1]
Nanoprobe Laboratory for Bio & Nanotechnology and Biomimetics (NLBB)
The Ohio State University
201 W. 19th Avenue, Columbus, Ohio 43210-1142, USA

Abstract

Fast-swimming sharks have scales with microgrooves called riblets aligned in the direction of fluid flow. Riblets result in water moving efficiently over the surface. In previous experimental and modeling studies, it has been shown that riblets provide drag reduction by lifting vortices formed in turbulent flow decreasing overall shear stresses. Riblets have shown drag reductions on the order of 10% when compared to a flat surface. Modeling data of blade riblets exist showing the role of drag and vortex structures. However, various other geometries have not been modeled. To optimize riblet geometries for low drag, three different geometries were modeled and their drag properties and vortex structures were compared. In addition, a shark-inspired geometry with riblets arranged in a scale pattern was modeled to compare shark scales to these riblet geometries. Through this work, optimal riblet geometries and dimensions were determined. A better understanding of riblet design for drag allows for the fabrication of drag-reducing surfaces in transportation, medical, and industrial applications. Riblet features in the designs can range from the micro- to nanoscale dependent upon the scale of the components.

Keywords:

Antifouling; frictional drag; low drag; riblet; shark skin

[1] Corresponding author: bhushan.2@osu.edu