Bio-inspired Surfaces: Fabrication of Shark Skin Using Glancing Angle Deposition (GLAD)

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Abstract

Often the characteristics and properties used for human innovation are found in the micro and nanostructures in nature. Examples include cicada wings, lotus leaves, and firefly wings. This research focuses on shark skin, which consists of stacking 3D dermal denticle microstructures. These structures are hydrophobic, drag-reducing, and anti-fouling, preventing the accumulation of microorganisms. There are a variety of applications for shark skin inspired surfaces, ranging from catheters and swimsuits to ship hulls and airplanes. Current fabrication for similar surfaces includes 3D printing, electron beam lithography, and molding directly from shark skin. These methods can be costly, inefficient, and unable to scale down complex structures. Scaling down is necessary because smaller devices require similar features. An alternative fabrication method for shark skin is glancing angle deposition (GLAD), a physical vapor deposition process with high incident angles. In this research, shark skins were fabricated by GLAD with periodic line seeds. Firstly, the line seeds were designed as repeating triplets to imitate the three ridges on the shark dermal denticle. Individual shapes included squares, rectangles, parabolic curves, and semicircles. Each unique shape had different periods created to determine the ideal dermal denticle spacing. After photolithography to obtain the line seeds, GLAD was performed to create the 3D effect of the skin. Characterization of the resulting surface will be conducted with a scanning electron microscope (SEM). Water contact angle (WCA) for hydrophobicity and fluid mechanics for drag will be shown.

Biography of Presenter

Luca Caruso recently completed his second year of studies at George Washington University. He is majoring in biomedical engineering and aspires to attend graduate school or work in the medical device industry after graduation. At George Washington University, Luca is a Clark Engineering Scholar and a member of Theta Tau, a professional engineering fraternity. He has worked as a learning assistant for the biology department. Luca is greatly interested in biomechanics, prosthetics, and micro and nanotechnology in medicine and healthcare.