The Summer Undergraduate Research Fellowship (SURF) Symposium
3 August 2017
Purdue University, West Lafayette, Indiana, USA

3D-Printed Microswimmers with Nanostructures for Color Tracking

Cara A. Koepele, Maria Guix, David Cappelleri
School of Mechanical Engineering, Purdue University

ABSTRACT

Two-Photon Polymerization (TPP) is a fabrication technique based on the localized linking of photosensitive materials resulting from femtosecond – a quadrillionth of a second – exposure to a laser. Such materials are based on building blocks named monomers that combine under certain stimuli (i.e. light) to form chains or complex networks. Utilization of TPP as a method for micro-3D printing has expanded the field of microrobotics, which presents medical solutions for minimizing procedure invasiveness as well as increasing treatment and diagnosis accuracy. One of the challenges in achieving desired accuracies is designing trackable features onto a microrobot. With the capabilities of TPP, we propose the construction of patterns on microrobot surfaces, mimicking color-expressing nanostructures present on beetles and butterflies. In this study, a tracking point is defined by these patterns on top of a surface on a helical microswimmer. A side-by-side comparison of various patterns determined which responds favorably to visible light. Microswimmers are decorated with the structures that elicit bright and stable reflections, and the whole design is printed and magnetized. The helix moves using an external rotating magnetic field and the color expressing features of the microswimmer are visible. Many microrobotic tracking systems are vision-based, thus, this patterning technique has the potential to mark multiple microrobots for differentiation, or even specific features on a singular robot to track displacement-type functionalities for improvement of microrobot control.

KEYWORDS

microrobot, 3D-printing, magnetic microrobot, colored nanostructures, tracking