Society of Engineering Science 51st Annual Technical Meeting

1–3 October 2014

Purdue University, West Lafayette, Indiana, USA

Designing bioinspired ondemand displays by electroactivating mechanochemically responsive elastomers

Wang, Qiming, qmwang1988@gmail.com; Gossweile, Gregory; Craig, Stephen; Zhao, Xuanhe, Duke University, United States

ABSTRACT

Cephalopods display dazzling colors by locally contracting skin muscles that reversibly activate chromatophores pigments. Inspired by this bioluminescent strategy, we demonstrate a new on-demand display by selectively activating a mechanochemically responsive elastomer controlled by external electric fields. The mechanoresponsive elastomer covalently embedded with mechanochromic molecules, if loaded with sufficiently large force, can reversibly emit visible color and strong fluorescent signals. Upon this reactive elastomer, we employ a controlled electric field to trigger a self-assembled topological pattern that features patterned large deformation, hence displaying a fluorescent pattern. The fluorescent intensity can be predicted by analyzing three-dimensional deformation of the reactive elastomer. We demonstrate on-demand displays such as self-assembled fluorescent rings and lines, and other arbitrary geometries such as letters. The reported technique may pave ways for creating next generation optoelectronics, biomedical luminescent devices, dynamic camouflage coatings, and photoelastic elastomer for damage detection.