

LIGHT-TUNABLE LIQUID CRYSTAL NETWORK ACTUATORS: TOWARDS PROGRAMMABILITY AND AUTONOMOUS DECISION MAKING

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Natural systems act as an endless source of inspiration for scientific research. Recently, stimuli-responsive liquid-crystalline polymer networks have been used to mimic diverse motions of biological species. One of the grand challenges in biomimetic research is to mimic the autonomy and adaptivity of living systems, and self-action in response to certain environmental changes in, e.g., light level, temperature, or relative humidity. This talk covers our recent efforts towards bioinspired autonomous and adaptive actuators. Two such examples will be shown. The first one will present a flytrap-inspired autonomous gripping device that is able to autonomously capture objects and differentiate between them, based on the optical feedback (reflectance) received [1]. The second example deals with “humidity-gated photoactuation”, that is, the interplay between light and humidity in dictating the actuation mode of liquid crystal networks. Using such multi-responsive actuators, we demonstrate a nocturnal-flower-mimic, which “blossoms” only in the dark and when the humidity level is low [2]. Finally, an approach towards reconfigurability/programmability, i.e., obtaining different actuation modes under identical light stimulation (as exemplified in the figure below), is presented [3]. The approach is based on synergistic use of photochemical and photothermal actuation mechanisms in liquid crystal networks. In the future we plan to combine these different aspects – autonomy, adaptivity and programmability – to yield ever-more sophisticated light-driven actuators or soft robots.



[1] O. M. Wani, H. Zeng, A. Priimagi, *Nat. Commun.* **8**, 15546 (2017).

[2] O. M. Wani, R. Verpaalen, H. Zeng, A. Priimagi, A. P. H. J. Schenning, *Adv. Mater.* **31**, 1805985 (2019).

[3] M. Lahikainen, H. Zeng, A. Priimagi, *Nat. Commun.* **9**, 4148 (2018).