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Photogated motility in smart actuators with dual response

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Humidity-driven motion is a fundamental process of energy conversion that is Essential for applications which require contactless actuation in response to the day-night rhythm of atmospheric humidity. In this work we demonstrate that mechanical bistability caused by rapid and anisotropic adsorption and desorption of water vapor by a flexible dynamic element which harnesses the chemical potential across very small humidity gradients for perpetual motion can be effectively modulated with light. A mechanically robust material capable of rapid exchange of water with the surroundings was prepared that undergoes swift locomotion in effect to periodic shape reconfiguration with turnover frequency of <150/min. The element can lift objects ~85 times heavier and can transport cargos ~20 times heavier than it. Having an azobenzene-containing conjugate as a photoactive dopant, this entirely humidity-driven self-actuation can be controlled remotely with ultraviolet light, thus setting a platform for a new generation of smart biomimetic hybrids. The actuating material can operate in the dark and could be utilized to convert the humidity into electrical power in low-power devices driven by humidity and/or light.

Biography

Lidong Zhang is a postdoctoral associate of material chemistry in Professor Naumov group, in New York University Abu Dhabi. His current research interests focus on novel smart polymer hydrogel actuators for energy transfer, biosensor and soft robot. He got his PhD from Pusan National University Korea, where he was working on smart polymer hydrogels for drug delivery, mineralization and catalysis under guidance of Professor Il Kim.

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