**[Photo-responsive hydrogel with a coupled chemo-mechano-electro response for rewritable shape-morphing and phototunable circuitry](https://acs.digitellinc.com/acs/live/22/page/677/6?eventSearchInput=&eventSearchDateTimeStart=&eventSearchDateTimeEnd=&eventSearchTrack%5b%5d=201" \l "sessionCollapse394121)**

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Nature creatures constantly evolving shapes and properties to realize various functions and adapt to the environment. Hydrogels as a biocompatible, highly deformable, and versatile stimuli responsiveness have the potential to mimic the adaptiveness of creatures. Traditional stimuli-responsive hydrogel usually possesses a pre-set mechano- or electro- responsiveness during fabrication. The lack of tunability and reconfigurability of those stimuli-responsive hydrogels limit their application where multifunctionality is appreciated.
In this work, a general scheme of shape and conductivity reconfigurable hydrogel with chemo-mechano-electro responsiveness using photo-ionizable molecules is proposed. Two molecules that can form a reactive ion couple upon light activation are incorporated into one hydrogel. The reaction between the ion couples not only locks the photo-ionizable molecules in the activated states but also improves the photo efficiency by drives the reversible reaction forward. Through the coordination between these two molecules, the new photo-responsive gel can decouple the photopatterning process with the morphing process meanwhile memorize the conductivity state even if the light pattern is removed. Partial conversion of the photo-ionizable molecules can be achieved by control light exposure, making it possible to continuously tunable swelling and conductivity property. Taking advantage of the reaction reversibility, the photo-responsive molecules can be recovered from the activated state with a recovery stimulus. Then the hydrogel can be rewritten into a new shape or create new conductive paths with another light pattern. Based on the proposed general scheme, a specific example is given by incorporating the triphenylmethane leucohydroxide and o-nitrobenzaldehyde molecules into a polyacrylamide hydrogel. The re-programmable morphing and the reconfigurable conductivity with precise gradient control are demonstrated.

