Stimuli-Responsive Matrix-Assisted Colorimetric Water Indicator of Polydiacetylene Nanofibers

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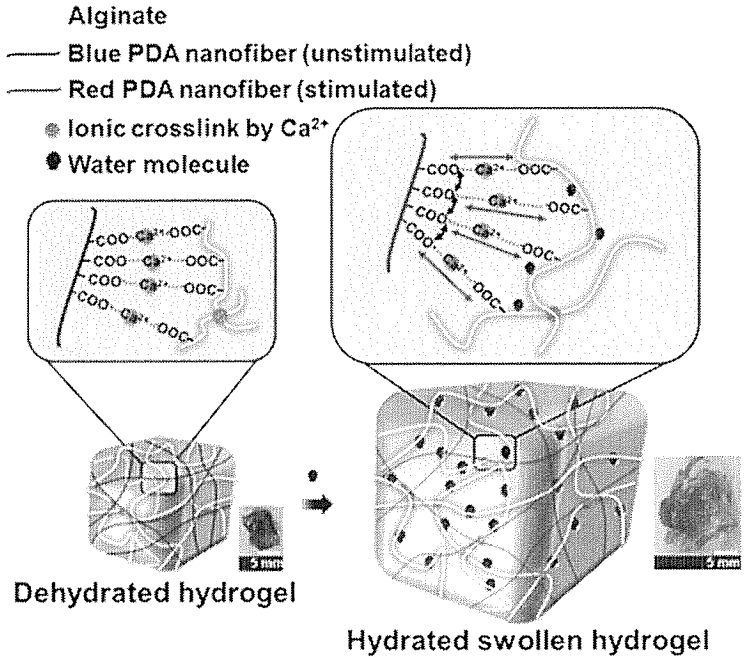
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Abstract



An alternative signal transduction mechanism of polydiacetylene (PDA) sensors is devised by combining stimuli-responsive polymer hydrogel as a matrix and PDA sensory materials as a signal-generating component. We hypothesized that volumetric expansion of the polymer hydrogel matrix by means of external stimuli can impose stress on the imbedded PDA materials, generating a sensory signal. PDA assembly as a sensory component was ionically linked with the alginate hydrogel in order to transfer the volumetric expansion force of alginate hydrogel efficiently to the sensory PDA molecules. Under the same swelling ratio of alginate hydrogel, alginate gel having embedded 1-dimensional thin PDA nanofibers (~20 nm diameter) presented a sharp color change while 0-dimensional PDA liposome did not give any sensory signal when it was integrated in alginate gel. The results implied that dimensionality is an important design factor to realize stimuli-responsive matrix-driven colorimetric PDA sensory systems; more effective contact points between 1-dimensional PDA nanofibers and the alginate matrix much more effectively transfer the external stress exerted by the volumetric expansion force, and thin PDA nanofibers respond more sensitively to the stress.