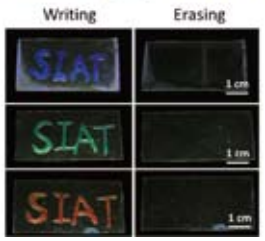
Technology

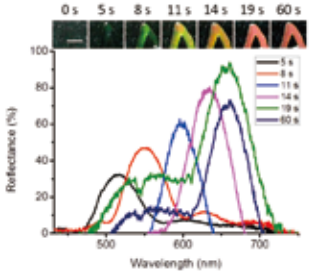
Water as a Colorful Ink: Transparent, Rewritable Photonic Coatings Based on Colloidal Crystals Embedded in Chitosan Hydrogel

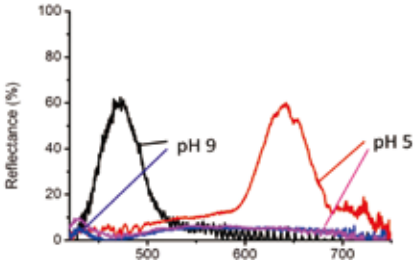
Although our current century is dominated by the use of electronic devices, paper is still believed to play a crucial role in information storage and distribution with the evidence of its tripled global consumption over the past decades. With more than 90% of all information in businesses printed on paper, most of them are disposed after only one-time reading and without de-ink. This not only is a huge waste but also brings disastrous impacts to the environment such as the pollution of air, water and land. Rewritable paper that can be reused for multiple times, therefore, is an attractive alternative to support a perfect balance between economic development and environmental protection.

A research group led by WU Tianzhun at the Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences has developed a new rewritable paper with water as a colorful ink by using water as the trigger to tune the band-gap of photonic crystal coatings on solid substrates. The researchers found that various colors could be achieved by adjusting the particle size of photonic coatings, or writing with aqueous solutions of certain pH. The photonic coatings can be erased and rewritten multiple times with no significant loss in color quality. Furthermore, the photonic coatings, which are transparent, enable fast and convenient visualization of the invisible photonic patterns with good tenability and reproducibility, offering potential applications for steganography, identification marking and anti-counterfeiting purposes.

This kind of transparent and rewritable paper can serve as an environmentally friendly information storage device to meet the sustainability of modern society. Their work, which has been published in the *Journal of Materials Chemistry C*, was supported by the China Postdoctoral Science Foundation, National Natural Science Foundation of China, Guangdong Innovative and Entrepreneurial Research Team Program, and the Shenzhen Peacock Plan.







(Left below) The reflection spectra of dynamic writing processes of the photonic coatings with particle size of *ca.* 225 nm. The scale bar is 0.5 mm. **(Right below)** The reflection spectra of the photonic coatings with particle size of *ca.* 174 nm after writing with various aqueous buffers of pH 5 (red line), pH 9 (black line), and erasing after water evaporated (purple line and blue line).