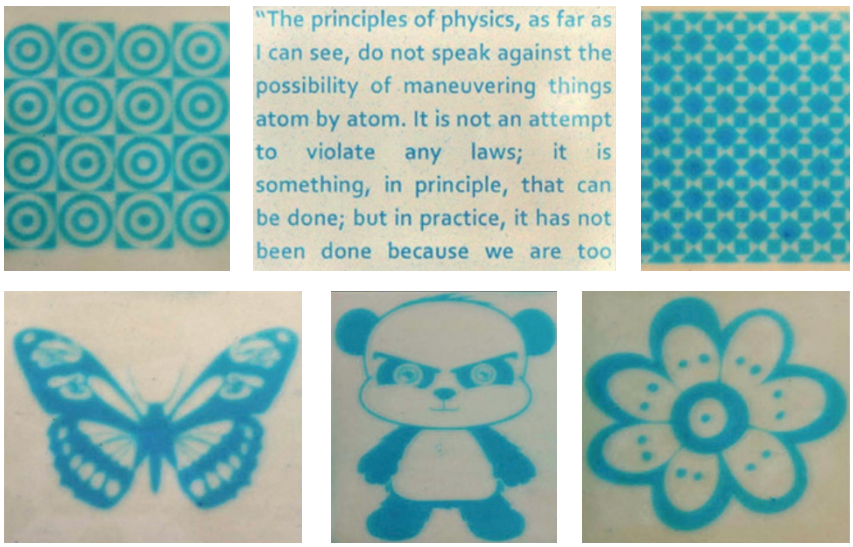
CHEMICAL PAPER

Writing with light

A rewritable chemical paper based on redox dye reactions driven by ultraviolet light could turn out to be an environmentally friendly alternative to regular paper, according to its inventors. Developed by Yadong Yin's research group at the University of California, Riverside, the new form of paper consists of a film composed of TiO_2 nanocrystals, a redox dye such as methylene blue (MB) and hydroxyethyl cellulose (*Nature Commun.* **5,** 5459; 2014). Importantly, the MB dye can be switched between a usual blue coloured state and a colourless state through a reduction reaction that occurs when the TiO_2 is exposed to ultraviolet light and releases electrons. As a result, white on blue patterns such as text or images can be written into the film by simply passing ultraviolet light through a suitable mask or by scanning a beam across the film. Heating the film to 115 °C for 10 minutes promotes oxidation of the dye and returns it to its original blue state, erasing the printed white image. The printed images remain legible for several days in the absence of an erase process. The achievement of this long-term stability is attributed to the use of hydroxyethyl cellulose, which helps stabilize the dye and blocks oxygen diffusion in the film. Tests indicate that this cycle of writing and resetting can be performed over 20 times without significant loss in the contrast or resolution of the produced images. By using a fine photomask, the research team has been able to print patterns with sharply defined features as small as a few tens of micrometres in size, indicated the potential of the system for high-resolution printing. The inventors say that their rewritable paper has the potential benefit of being low-cost and non-toxic, as TiO_2 and MB are already widely used in cosmetics and medical products. Furthermore, the existence of other coloured redox dyes such as neutral red and acid green means that rewritable paper with all three primary colours is possible, although the creation of multicoloured images has yet to be demonstrated.



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OLIVER GRAYDON

BIOPHOTONICS

Bringing the living brain into focus

A fast scanning light-sheet microscope that produces multicolour, dynamic images of living tissue could provide fresh insights into the brain's neural circuits.

Alexander D. Corbett and Gil Bub

The ability to record the micrometre-scale neural circuitry of the living brain in three dimensions in real time as it operates has been the dream of neuroscientists for generations. The visualization of signals firing between interconnected forests of communicating neurons is captivating and the wealth of information contained in these images cannot be underestimated. Now, as they report in *Nature Photonics*, Matthew Bouchard *et al.*[1] have developed a scheme that makes this possible. Their work is part of a rapidly growing range of innovative technologies that are currently breaking new ground in biological imaging.

The list of challenges associated with imaging deep within the brain is long and conflicting. High laser powers are needed to overcome the substantial light loss due to scattering from tissue, but phototoxicity imposes limits on the excitation powers that can be used without harming living cells. Likewise, a high signal-to-noise ratio favours long exposure times, which is at odds with the goal of high temporal resolution and the visualization of dynamic processes. Multiphoton and higher-harmonic imaging modes can provide excellent contrast deep into tissue but the low-efficiency of the tissue interaction requires optical powers that limit the potential for spatial multiplexing and