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research highlights

PHOTOCATALYSIS

Into the dark

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Photocatalytic production of hydrogen from aqueous solutions provides a way to directly convert solar energy into fuel, thus having parallels with photosynthesis. Typically in artificial photosynthetic systems, the period of illumination is synchronized with the period in which hydrogen is produced — that is, when the light goes out, the hydrogen stops being generated. Erwin Reisner, Gunnar Jeschke, Bettina Lotsch and colleagues across Europe now demonstrate a photocatalytic system in which the solar irradiation time is decoupled from the hydrogen production time allowing energy to be stored and then released on demand during periods of no illumination.

The researchers use a partially ionic cyanamide-functionalized heptazine-based polymer as the photocatalyst, which is suspended in a solution containing an electron donor such as 4-mercaptobenzoic acid. On illumination, radicals — trapped electron species — are formed in the polymer; once the light is turned off, the electrons can reduce protons to hydrogen, induced using a catalyst such as colloidal platinum. Unfunctionalized versions of the same polymer do not exhibit this behaviour, indicating the importance of the cyanamide moiety to the formation of the radicals in the system. The radical species have relatively long lifetimes allowing hydrogen evolution to be instigated up to 12 hours after illumination has finished, which is sufficient to span periods of darkness in the diurnal cycle. ❐

James Gallagher