PURSUIT OF ZΩH — THE WEEKLY

*This Week in*

# Chemical Engineering

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THIS WEEK

## *Turnstiles, lasers and crowded catalysts*

A turnstile MOF sorts C6 rings, an organic sheet splits water unaided, crowded ruthenium cracks plastic toward methane, and a laser peels old panels for silver.

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01

SEPARATIONS

### A molecular turnstile sorts three C6 rings

Benzene, cyclohexene and cyclohexane have nearly identical properties, and the last two are almost the same size, which defeats sorbents with fixed pores.[1] A team led by Chongli Zhong at Tiangong University in Tianjin built a metal–organic framework whose pore mouths carry pairs of –CF3 groups that rotate with temperature.[1] At 303 K the gate admits only benzene; warmer, it opens for cyclohexene.[1] Inside, cyclohexene is held flat and moves freely, while cyclohexane is pinned in a hindered, eclipsed pose.[1,2]

> WHY IT MATTERS
>
> *Tested on a 100 g sample, the material is pitched as a lower-energy route for hydrocarbon purifications that resist static sieving.*[1,2]

CAVEAT *Lab-scale work up to 100 g; long-term durability is not described.*[1,2]

MECHANISM

303 K: only benzene enters

↓

Warmer: –CF3 gates rotate open

↓

Cyclohexene locked flat, diffuses in

↓

Cyclohexane locked eclipsed, stays out

[1] doi:10.1038/s44286-026-00462-4 · [2] doi:10.1038/s44286-026-00463-3

ON THE ROAD?

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02

SOLAR FUELS

## One organic film, two jobs: a sheet that splits water unaided

Photocatalyst sheets sidestep some drawbacks of wired photoelectrochemical cells and of powder slurries, but existing sheets rely on inorganic nanoparticles that are hard to process at scale.[3] Kevin Sivula's group at EPFL used one solution-processed polymer blend instead.[3,4] On a carbazole-based contact the film makes hydrogen; on a naphthalimide-based contact it makes oxygen, because the two contact molecules carry opposite dipoles.[4] Printing both contacts as microdomains on one substrate and adding platinum and iridium-oxide cocatalysts gave a sheet that split water under simulated sunlight for more than 2 h with no applied bias.[3,4]

WHY IT MATTERS

*Organic semiconductors can be coated from solution, and the team showed that the patterned underlayer can also be sprayed on, a possible route to larger sheets.*[3,4]

CAVEAT *Efficiency is far too low for practical use, as the authors note, and shrinking the domains below 1 mm lowered performance.*[4]

[3] doi:10.1038/s41560-026-02160-0 · [4] techxplore.com

**0.1%**

solar-to-hydrogen efficiency; hydrogen at a stabilized 1.3 μmol $h^{-1}$ $cm^{-2}$ under simulated sunlight

SOURCE 3

03

CATALYSIS FOR PLASTICS

## Crowd the ruthenium and plastic cracks toward methane

Packing metal particles more densely on a support usually changes their size too, so the two effects blur.[5] A team from Pacific Northwest National Laboratory, the University of North Texas and partners made ruthenium particles by reducing rutile RuO2 grown epitaxially on rutile TiO2, a close lattice match.[5] Size and shape held steady while density varied 16-fold.[5] In polyolefin hydrogenolysis, which cuts plastic chains with hydrogen, crowded particles let one chain adsorb on several at once, lowering surface hydrogen coverage and raising selectivity to methane.[5] Short alkanes that fit on one particle showed no effect.[5]

WHY IT MATTERS

*Particle spacing becomes its own dial on product mix in plastic upcycling, and small alkanes turn out to be poor stand-ins for real polymer chains.*[5]

CAVEAT *Laboratory study in Nature Catalysis; with polymers desorption limits the rate, whereas C–H bond activation limits it for short alkanes.*[5]

[5] doi:10.1038/s41929-026-01627-3

**16-fold**

range of Ru particle density at constant particle size and shape on rutile TiO2

SOURCE 5

04

RECYCLING PROCESSES

## A laser peels old solar panels so silver can be leached out

Old solar modules resist recycling because the EVA encapsulant clings to the cells, so most routes shred or heat the whole laminate.[6] Engineers at the University of Glasgow instead aim a 1064 nm fiber laser at the EVA–silicon interface alone, splitting a panel into an intact EVA film, separate busbars and a silicon-rich powder.[6,7] Sodium hydroxide strips aluminum from the powder, then an iron(III) chloride–choline chloride brine pulls out silver and leaves crystalline silicon behind.[6] The team is working with the Glasgow firm Watt Laser on a commercial version.[7]

WHY IT MATTERS

*Breaking the EVA seal conventionally takes 450–600°C or toxic chemicals; the team estimates the laser route cuts recycling power use by 84%.*[7]

CAVEAT *Paper online 3 Nov 2026; included because the University of Glasgow release appeared 10 Nov.*[6,7] *The 84% figure is the team's estimate.*[7]

[6] doi:10.1038/s43246-026-01424-2 · [7] gla.ac.uk

**>99%**

silver selectivity for one aged panel type (REC240PE); >95% for the other (CS6P-245P)

SOURCE 6

## WORDS THIS WEEK

### Metal–organic framework
A crystalline sponge built from metal nodes joined by organic linkers; its pores can be tailored to grab some molecules and reject others.

### EVA encapsulant
Ethylene–vinyl acetate, the clear polymer layer that glues solar cells to the front glass and seals them against moisture.

### Solar-to-hydrogen efficiency
The share of incoming sunlight energy that ends up stored as chemical energy in the hydrogen produced.

### Hydrogenolysis
Breaking carbon–carbon bonds with hydrogen over a metal catalyst; applied to polyolefins it chops plastic chains into smaller alkanes.

## SOURCES


1. PAPER M. Zheng et al., “Orientational locking in a turnstile metal–organic framework for cyclohexene/cyclohexane separation,” Nature Chemical Engineering (11 Nov 2026). doi:10.1038/s44286-026-00462-4
2. NEWS “Turnstile metal–organic framework for the efficient separation of cyclic C6 hydrocarbons,” Nature Chemical Engineering research briefing (11 Nov 2026). doi:10.1038/s44286-026-00463-3
3. PAPER N. J. Diercks et al., “An organic semiconductor-based photocatalyst sheet for overall solar-driven water splitting,” Nature Energy (11 Nov 2026). doi:10.1038/s41560-026-02160-0
4. RELEASE EPFL, “Organic semiconductor sheet enables light-driven water splitting without external voltage,” Tech Xplore (11 Nov 2026). https://techxplore.com/news/2026-11-semiconductor-sheet-enables-driven-external.html
5. PAPER L. Chen et al., “Ru/rutile-TiO2 catalysts with coverage-independent particle size and shape enable isolation of particle density effects in polyolefin hydrogenolysis,” Nature Catalysis (9 Nov 2026). doi:10.1038/s41929-026-01627-3
6. PAPER B. N. Alsulami et al., “Laser-induced delamination of aged silicon photovoltaic modules to achieve >95% selective silver recovery,” Communications Materials (3 Nov 2026). doi:10.1038/s43246-026-01424-2
7. RELEASE University of Glasgow, “Laser technique could slash emissions from solar panel recycling,” University of Glasgow News (10 Nov 2026). https://www.gla.ac.uk/news/headline_1302616_en.html


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