

Meet the scientists exploring how water shapes organic battery materials

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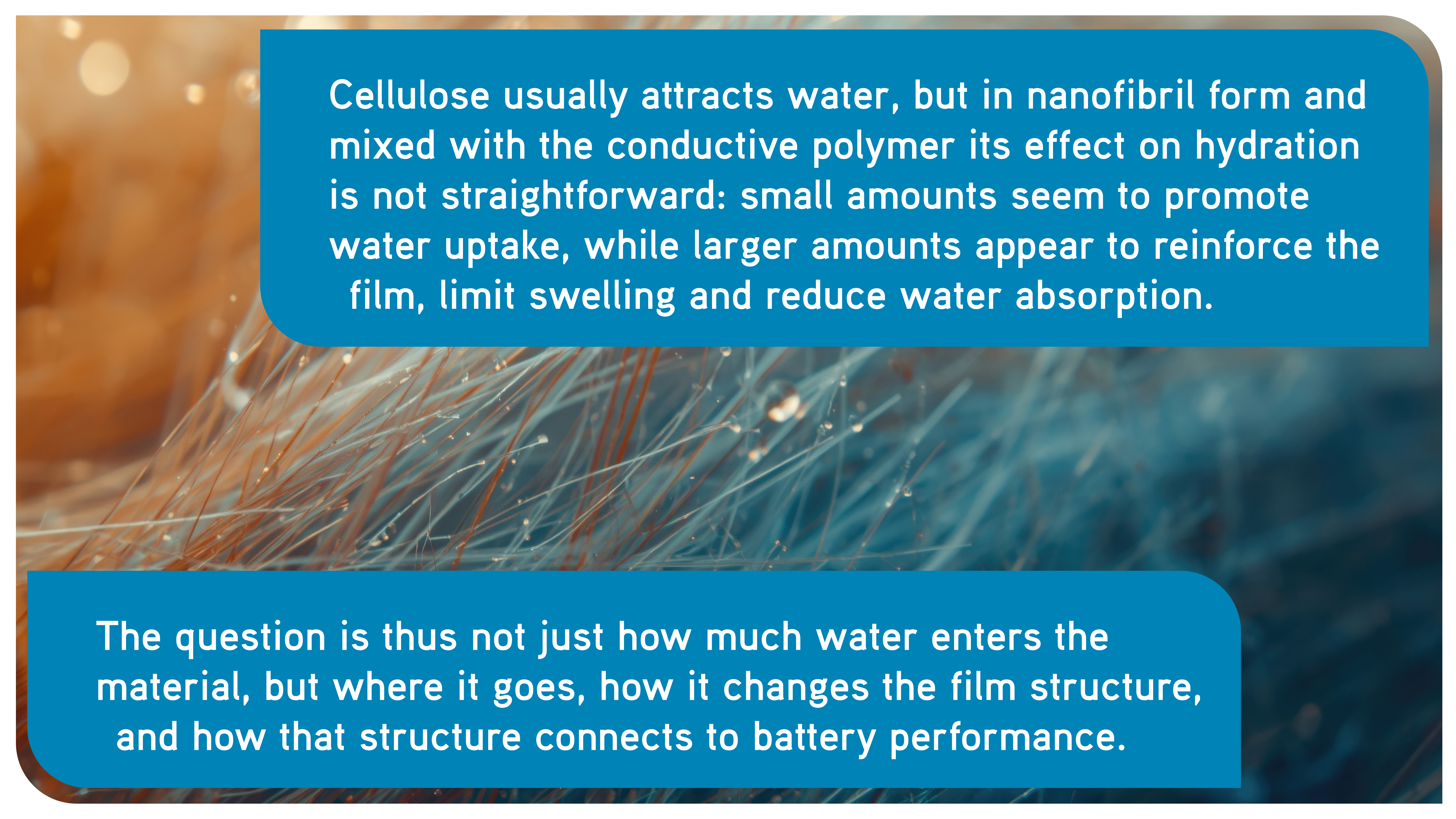
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Organic cathodes could offer a more sustainable route to energy storage, but when used in aqueous-compatible batteries, their performance depends on something deceptively simple: water.



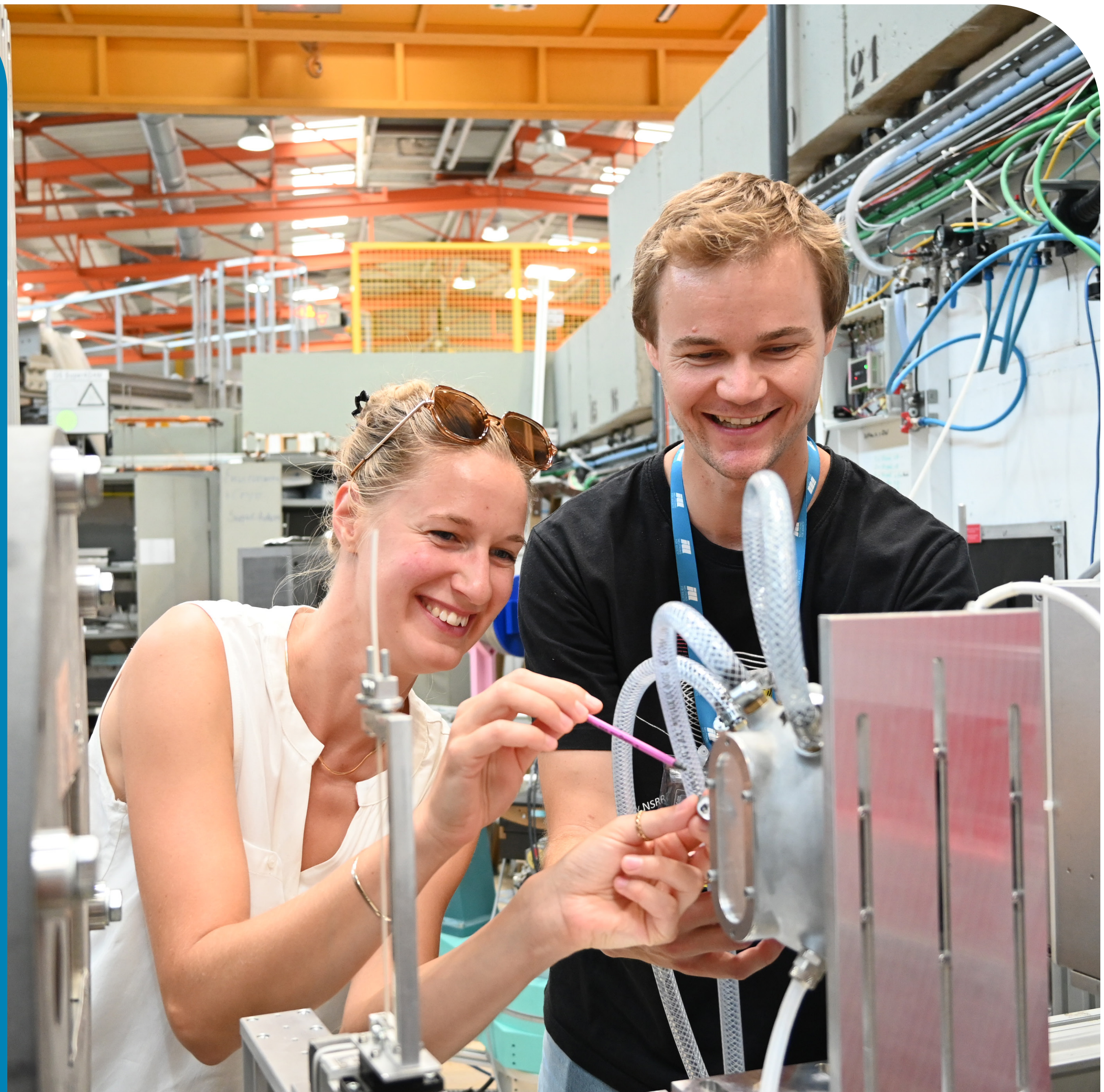
To tune the performance of organic conducting polymers, the team blends them with cellulose nanofibrils, but this creates an unexpectedly complex water behaviour.



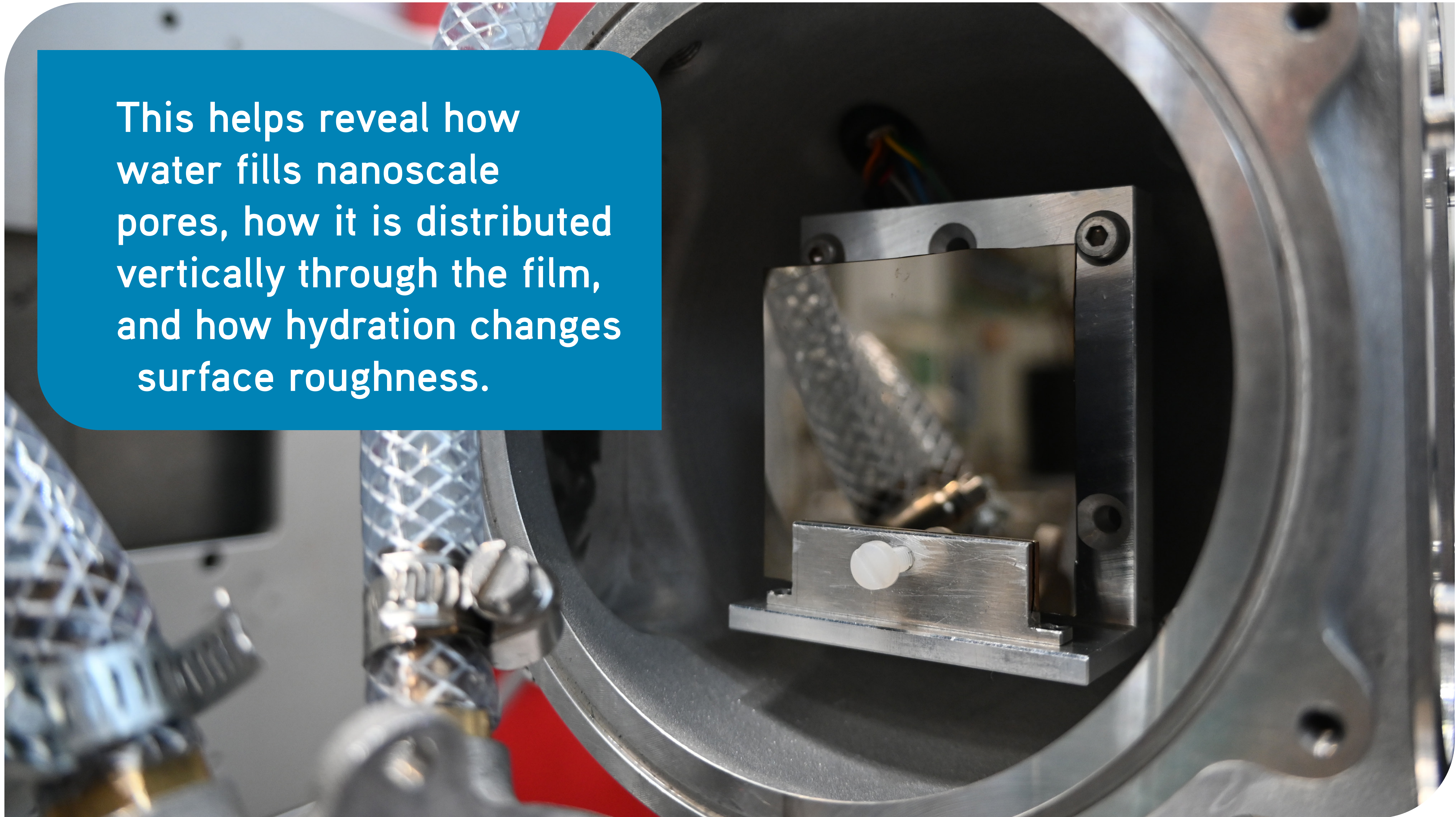
Cellulose usually attracts water, but in nanofibril form and mixed with the conductive polymer its effect on hydration is not straightforward: small amounts seem to promote water uptake, while larger amounts appear to reinforce the film, limit swelling and reduce water absorption.

The question is thus not just how much water enters the material, but where it goes, how it changes the film structure, and how that structure connects to battery performance.

Using SuperADAM, the team combines grazing-incidence small-angle neutron scattering with neutron reflectometry to look at the film in two complementary ways: across the surface and through its internal layering structure.



This helps reveal how water fills nanoscale pores, how it is distributed vertically through the film, and how hydration changes surface roughness.

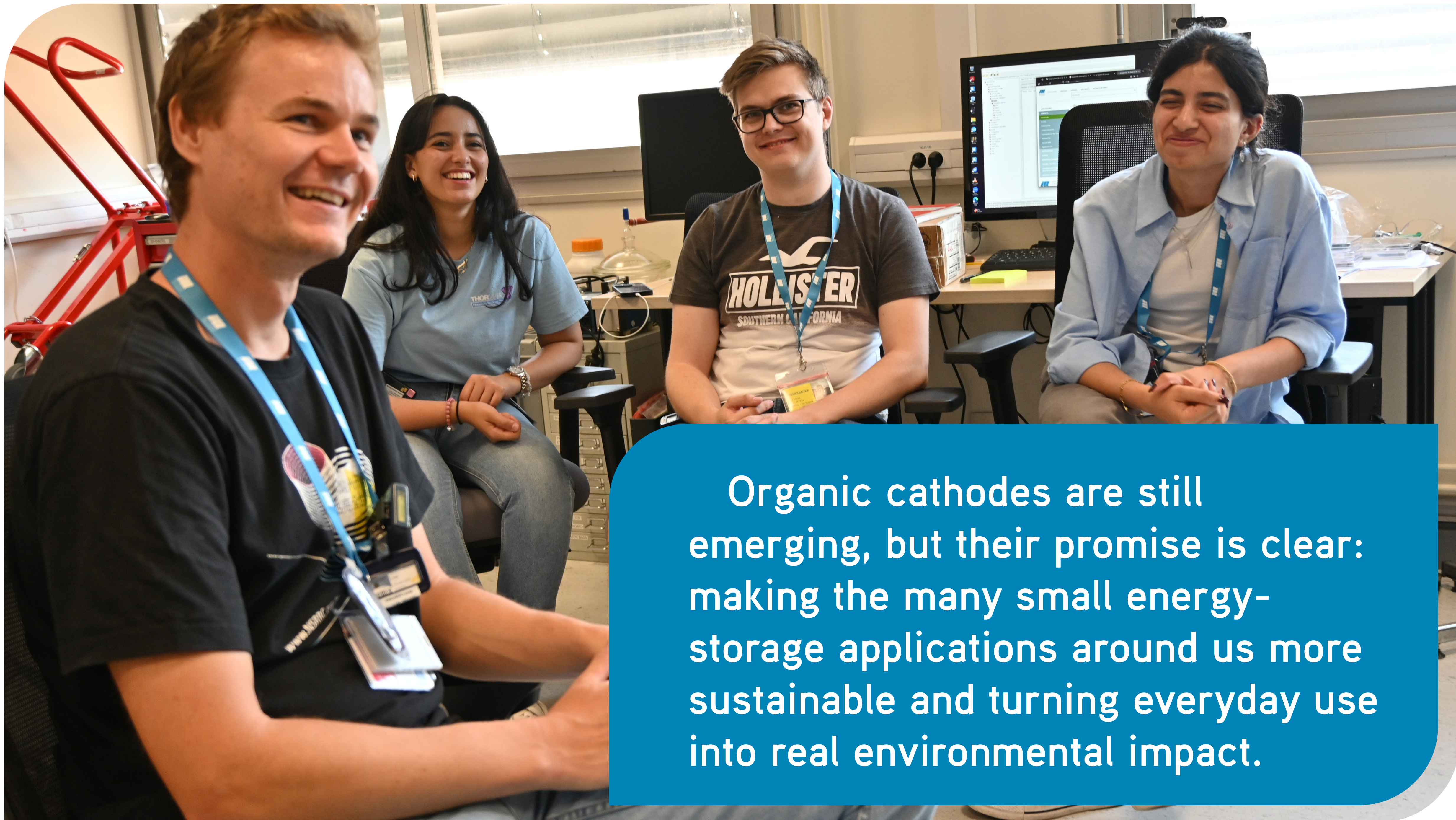


“Our previous QENS measurements on IN5 showed how water moves in these organic cathode films. With SuperADAM, we can now see how the film itself changes as it hydrates.

This will allow us to connect structural and dynamical properties to macroscopic electrochemical performance. ”

Lucas Kreuzer





Organic cathodes are still emerging, but their promise is clear: making the many small energy-storage applications around us more sustainable and turning everyday use into real environmental impact.