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# Nanodancing with moisture: humidity-sensitive bilayer actuator derived from cellulose nanofibrils and reduced graphene oxide

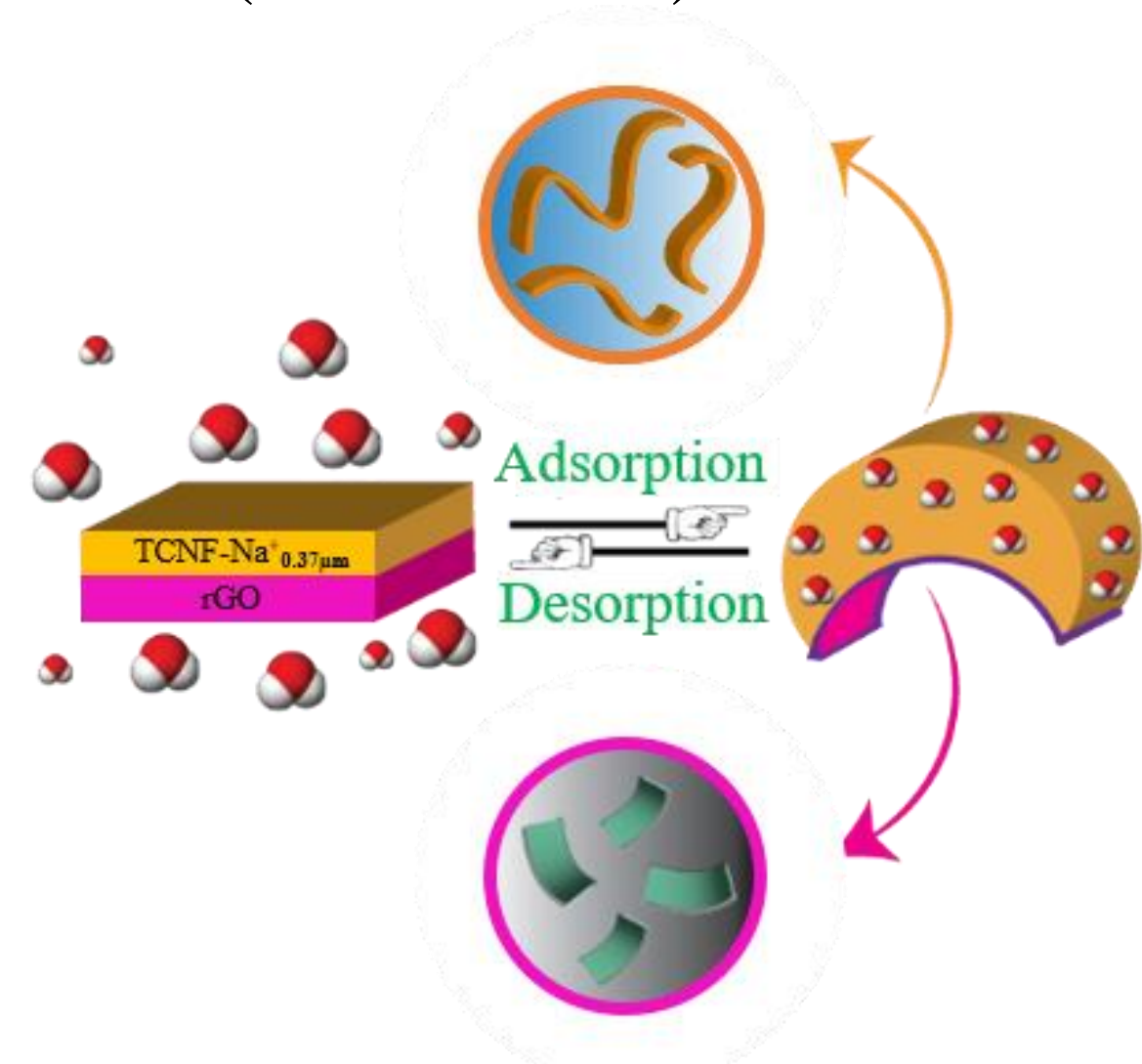
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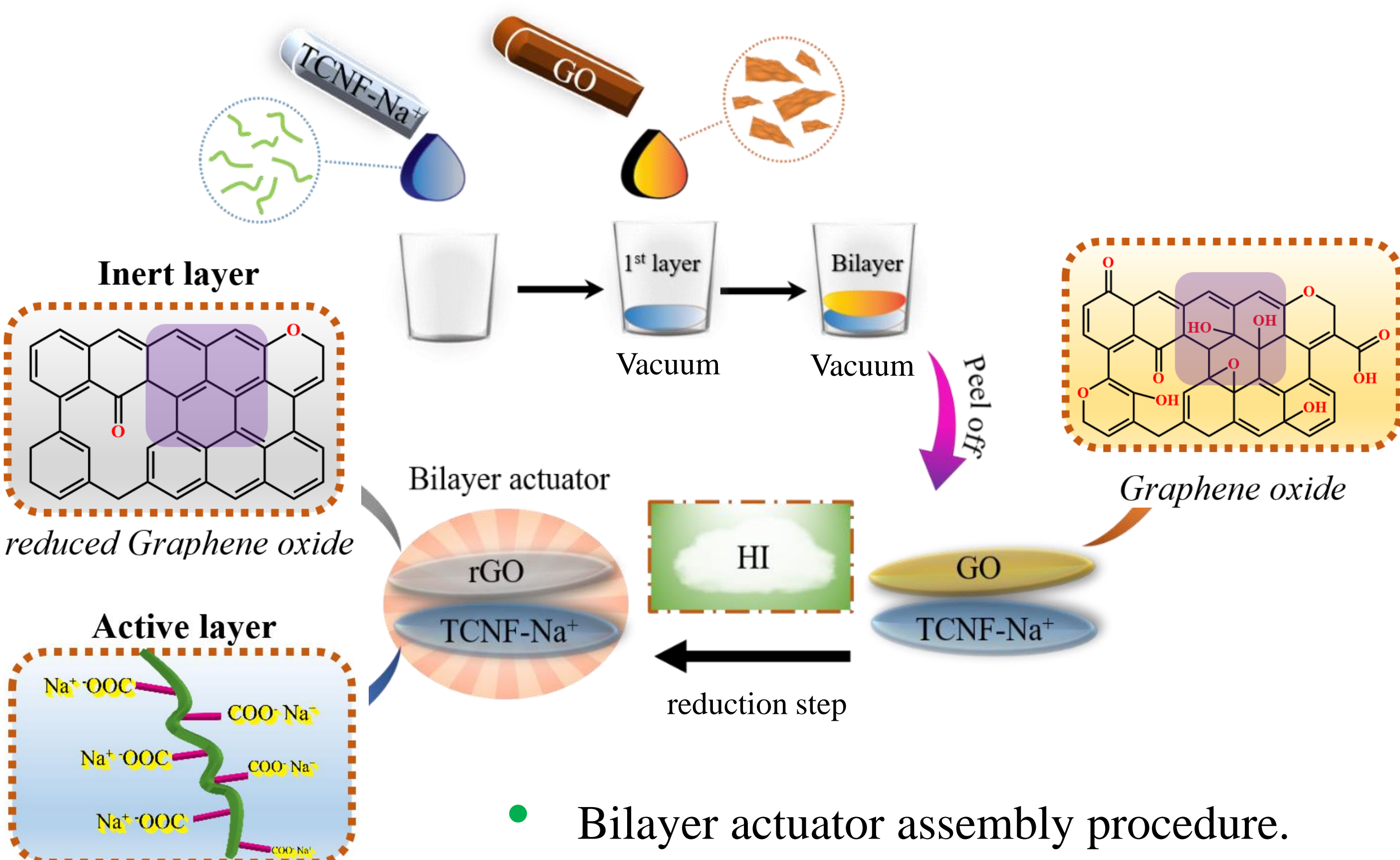


## SUMMARY

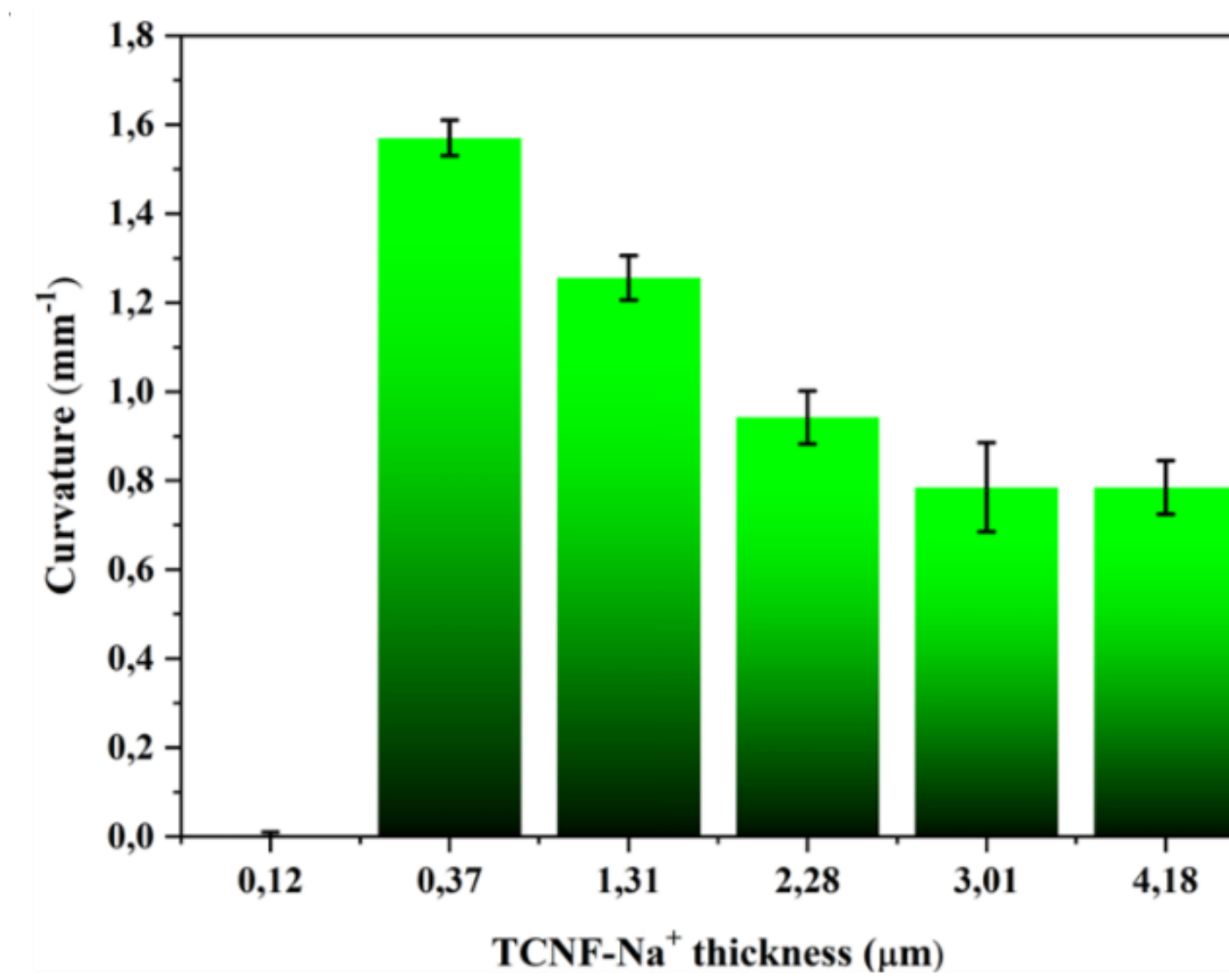
- Nanomaterial-based organic-inorganic humidity-sensitive bilayer actuator composed of cellulose nanofibrils (TCNF-Na<sup>+</sup>) and reduced graphene oxide (rGO) nanosheets.
- TCNF-Na<sup>+</sup> layer adsorbs water molecules, while rGO film acts as an inert layer with a few to no interaction with water molecules.



## METHODS

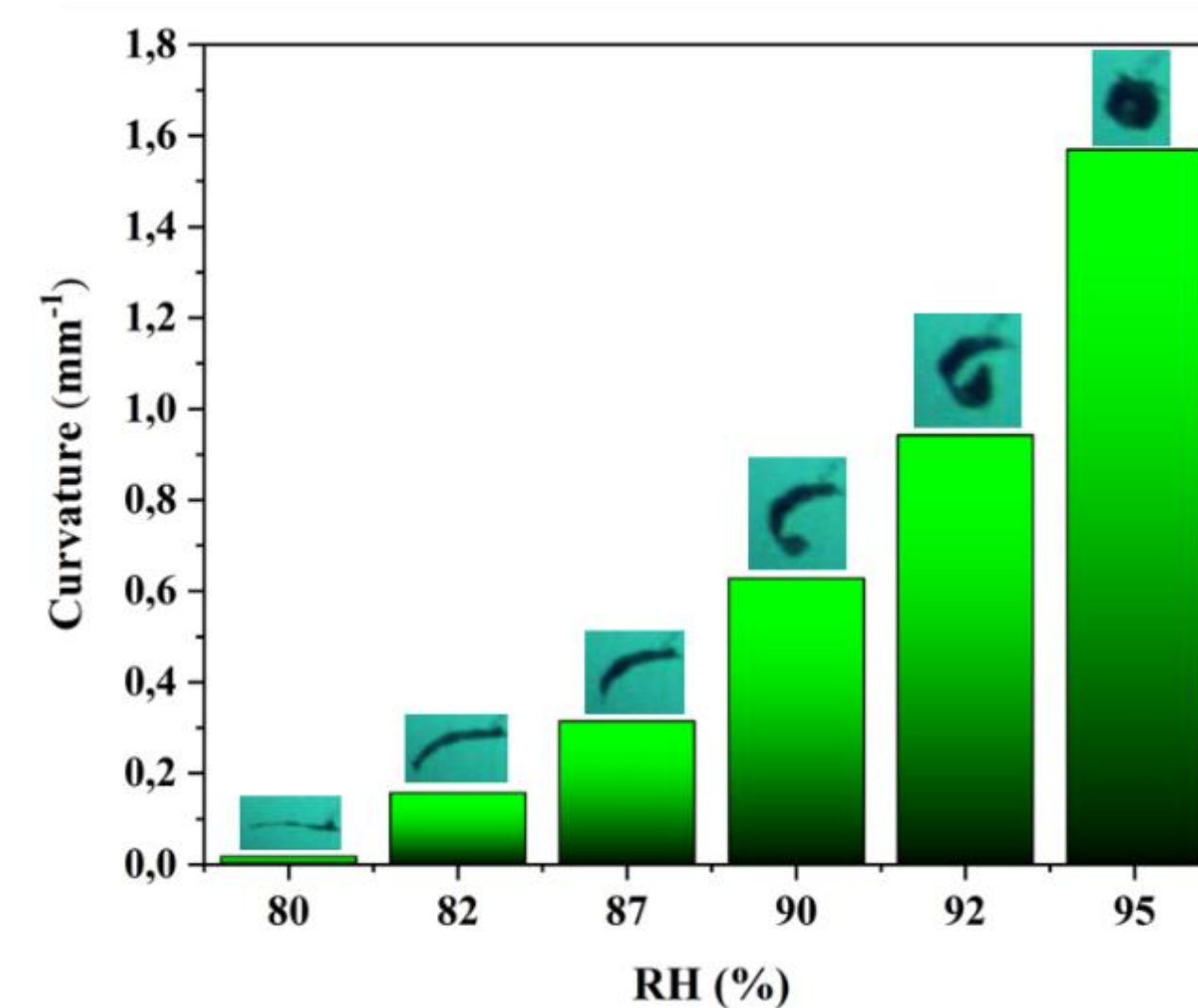
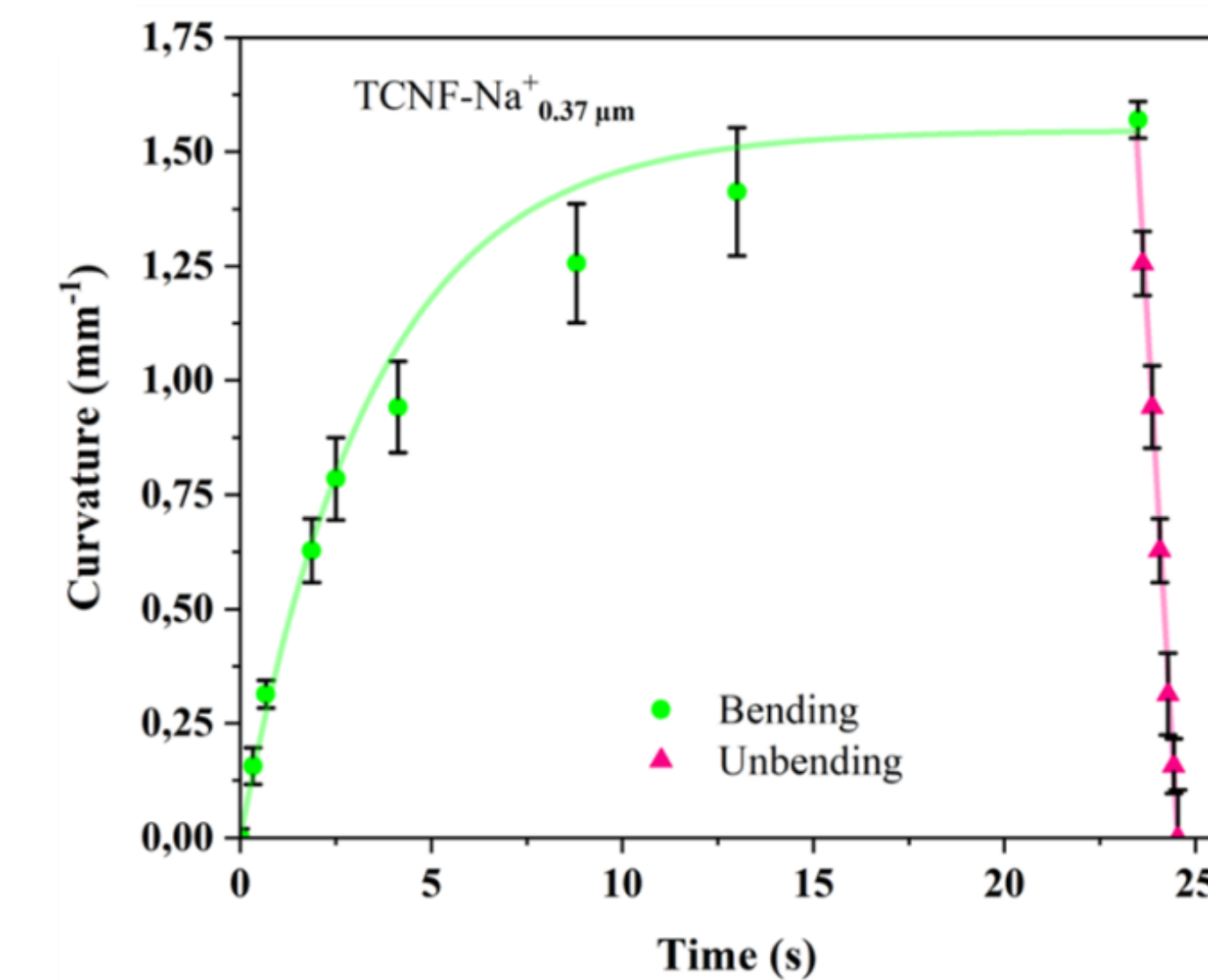


## RESULTS

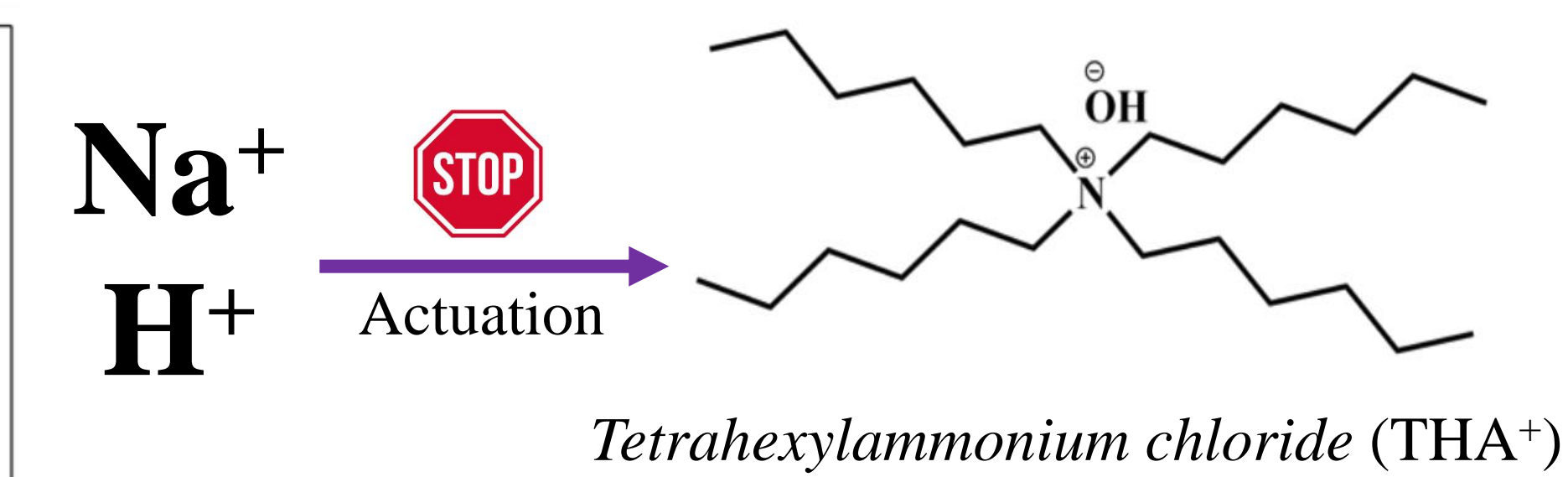
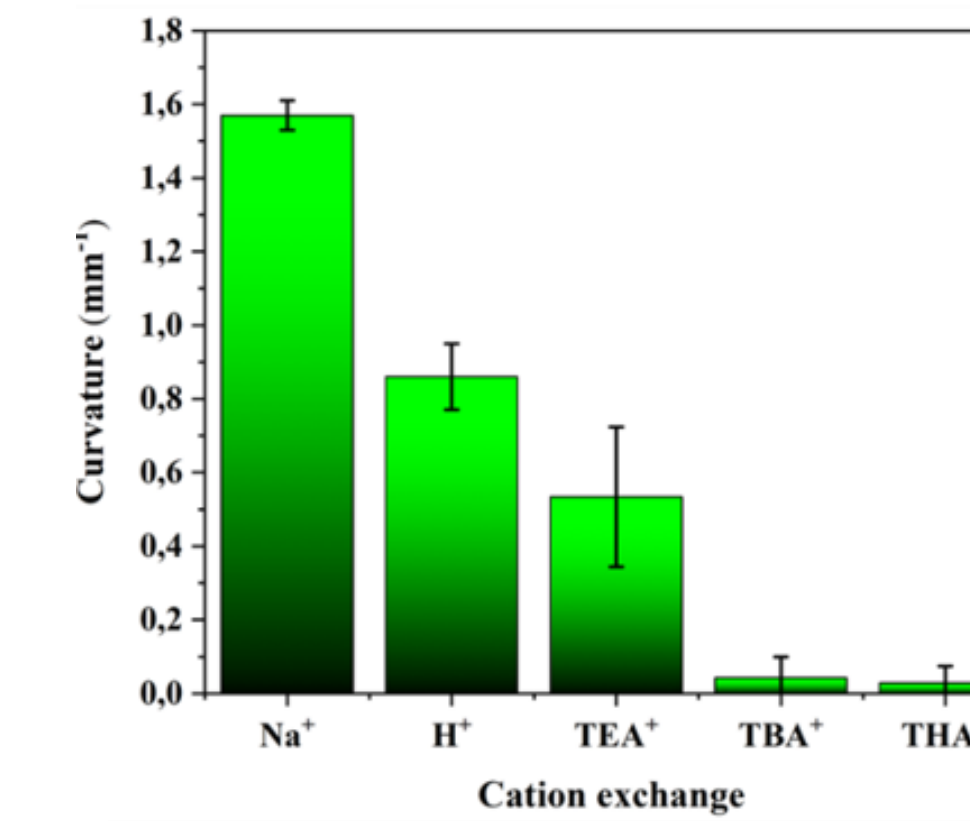


- Optimization process of the bilayer actuator by measuring the highest curvature at 95% RH for different TCNF-Na<sup>+</sup> thicknesses.

- Curvature kinetics of the fastest constructed actuator [TCNF-Na<sup>+</sup> 0.37 μm] from 25 to 95% RH (bending) and back to 25% RH (unbending).

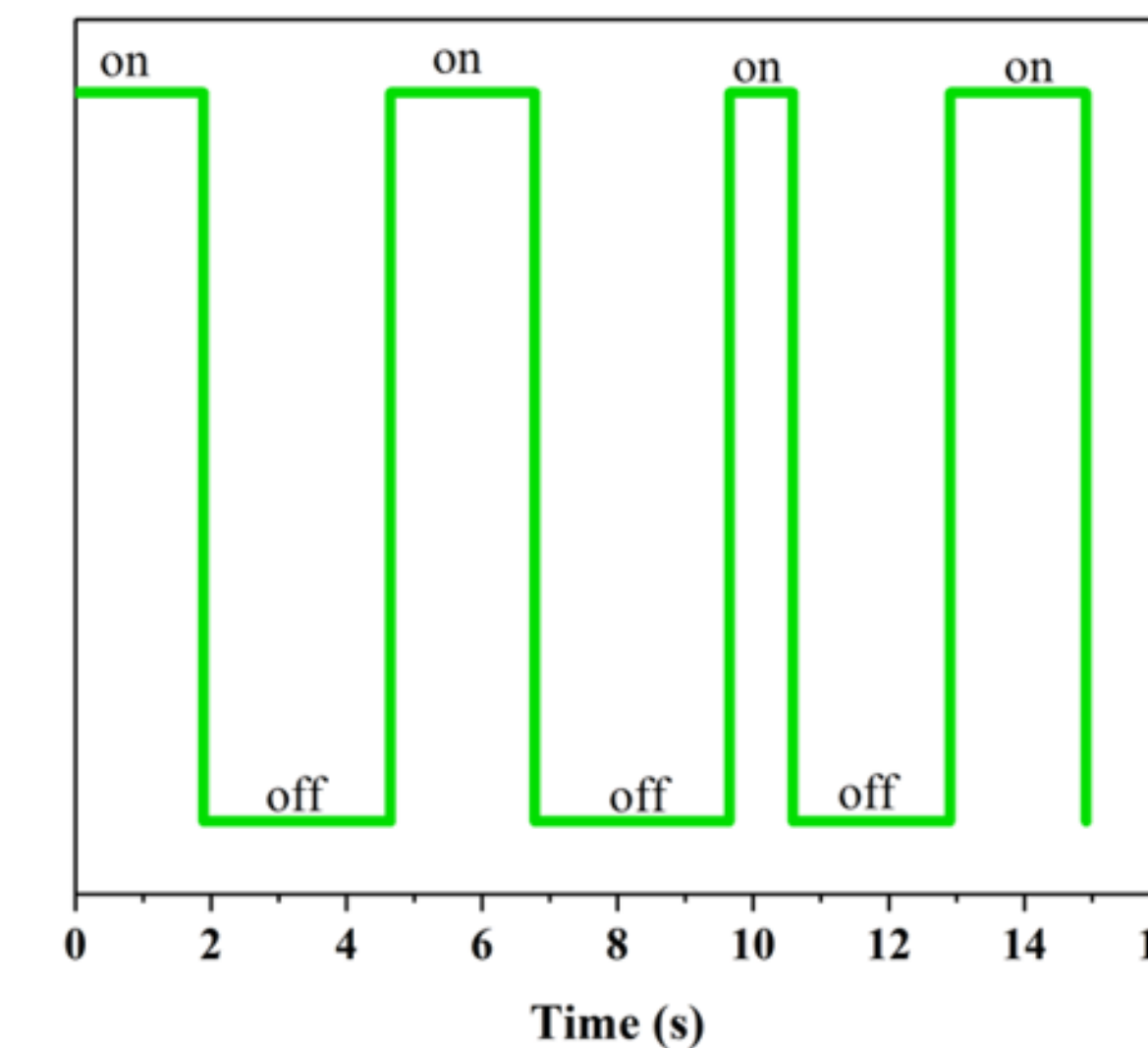
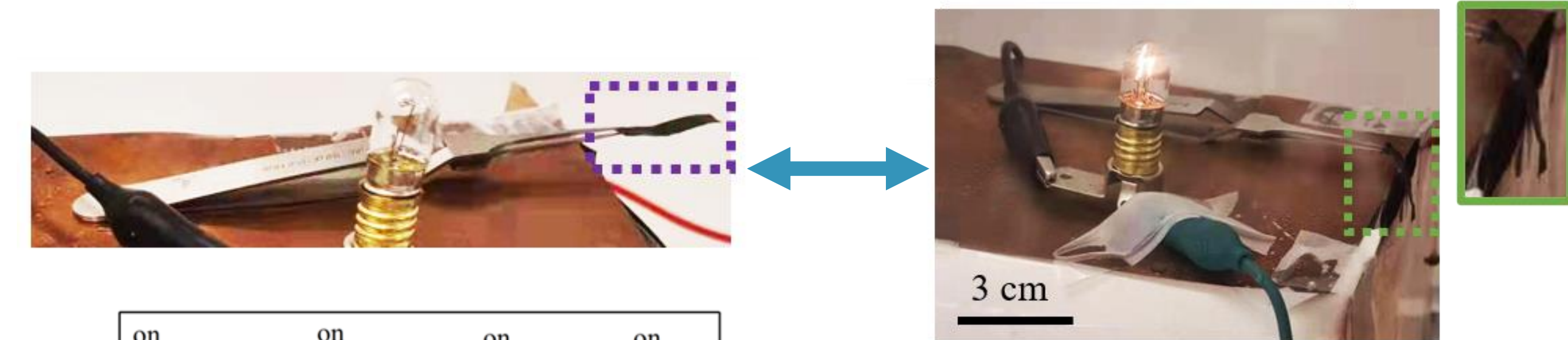


- Maximum curvature of TCNF-Na<sup>+</sup> 0.37 μm increases as RH gets higher and higher.



- Cation-exchange can be employed to control the degree of actuation.

## NANODANCING



- An autonomous on-and-off lighting device at 92% RH.
- Oscillating *On* and *off*-states as a function of time due to TCNF-Na<sup>+</sup> 0.37 μm cyclic actuation.

## ACKNOWLEDGEMENTS

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