WATER RESPONSIVE TRIPEPTIDE-CRYSTAL

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Abstract

The possibility of harvesting evaporation energy from biological systems has been gaining interest in recent years. Potentially useful materials for this purpose have been classified as water-responsive (WR)[1] and can withstand reversible structural changes upon varying humidity levels. These materials have shown evaporation-induced mechanical deformation, a feature that can potentially be used in electricity generation and green chemistry applications. Remarkably, previous works reported that the hydrogen bonding network in the aqueous nanopores plays a crucial role for WR [2], as well as the ratio between bounded/mobile water. Flexibility and porosity have also been identified as essential design factors for WR. As building blocks, peptides can be designed to have a mechanically robust and flexible structure. In this work, we study a self-assembling tripeptide crystal composed of arginine, tyrosine, and phenylalanine (RYF). We characterized it using techniques such as AFM, XRD, DVS, DSC, and TGA to understand how the supramolecular structure of RYF plays a role in its water responsiveness.

References

[1] H. Wang et al., "High Energy and Power Density Peptidoglycan Muscles through Super-Viscous Nanoconfined Water," Advanced science, vol. 9, no. 15, pp. e2104697-n/a, 2022, doi: 10.1002/advs.202104697.

[2] R. Piotrowska et al., "Mechanistic insights of evaporation-induced actuation in supramolecular crystals," Nature materials, vol. 20, no. 3, pp. 403-409, 2021, doi: 10.1038/s41563-020-0799-0.