

## Chem-Bio Hybrid, a Chemically Engineered Enzyme Encapsulated in a Molecular Cage

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Spatial isolation of molecules is often a powerful strategy for regulating their molecular behavior. Biological systems well-employ such mechanisms, however, scientists have yet to rival nature, particularly for macromolecular substrates. We demonstrated that a “wireframe” molecular scaffold improves the structural and enzymatic properties of a protein encapsulated within. Particularly, when the three-dimensionally confined enzyme was exposed to an organic solvent, its half-life was prolonged 1000-fold. Kinetic and spectroscopic analysis of the enzymatic reaction revealed that the key to this stability is the isolated space; this is reminiscent of chaperonins, which use their large internal cavities to assist the folding of client proteins. The single-molecule protein-caging affords a new type of protein-based nanobiotechnology that accelerates molecular biology research as well as industrial applications.

Figure 1

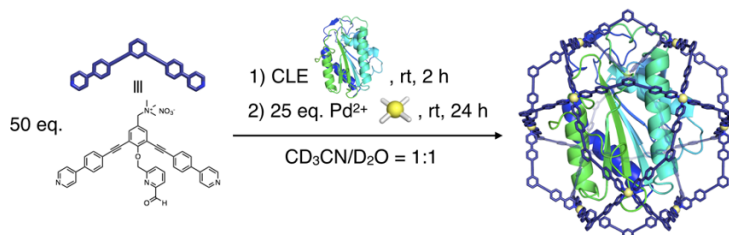
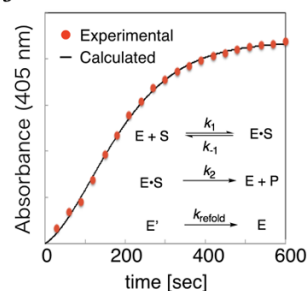


Figure 2



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