

Polymer folding: Pentacyclic geometries click into place

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Polymer folding studies are now attracting interest from geometrical mathematicians and biologists, as well as chemists. Many key proteins and peptides rely on programmed polymer folding into specific shapes to function, while the mathematics of complex geometries also benefit from insights offered from newly crafted polymer morphologies. Now alongside colleagues Hiroyuki Heguri and Takuya Yamamoto at Tokyo Tech, Yasuyuki Tezuka shows how combining "click-clip" chemistry with previous methods can produce some of the most complex cyclic polymer geometries achieved in the lab so far.

Tezuka and his collaborators had already demonstrated that electrostatic self-assembly and covalent fixation (ESA-CF) can produce a variety of complex multicyclic, in particular fused di-, tri- and even quadracyclic polymer geometries. In this latest work he and his colleagues use ESA-CF to form cyclic precursors with strategically located alkyne, alkene and azide groups. The alkyne and azide groups can 'click' together to form a prescribed tetracyclic precursor. This is then folded through 'clipping' by olefin metathesis reactions—a common process for clean organic chemistry—to produce a quadruply-fused pentacyclic geometry. The final form resembles the 'shippo' shape often used in traditional Japanese art.

Size-exclusion chromatography and NMR measurements indicate a highly contracted size for the final pentacyclic product. "Accordingly, the programmed polymer folding could produce unusually compact polymer conformation in their 3D structures," conclude Heguri, Yamamoto and Tezuka in their report.

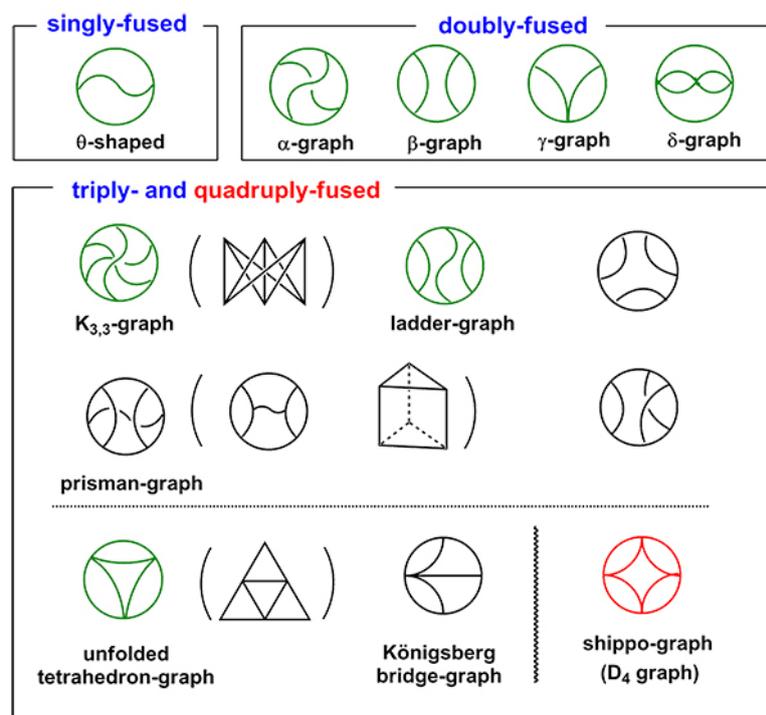


Figure.

Graph presentation of fused- multicyclic polymer topologies. Those in green are so far reported and in red are constructed in this work.

Reference

Authors: Hiroyuki Heguri, Takuya Yamamoto, and Yasuyuki Tezuka
Title of original paper: Folding Construction of a Pentacyclic Quadruply fused Polymer Topology with Tailored kyklo-Telechelic Precursors
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