Designer polyradical nanographenes with strong spin entanglement and perturbation resilience *via* Clar's goblet extension

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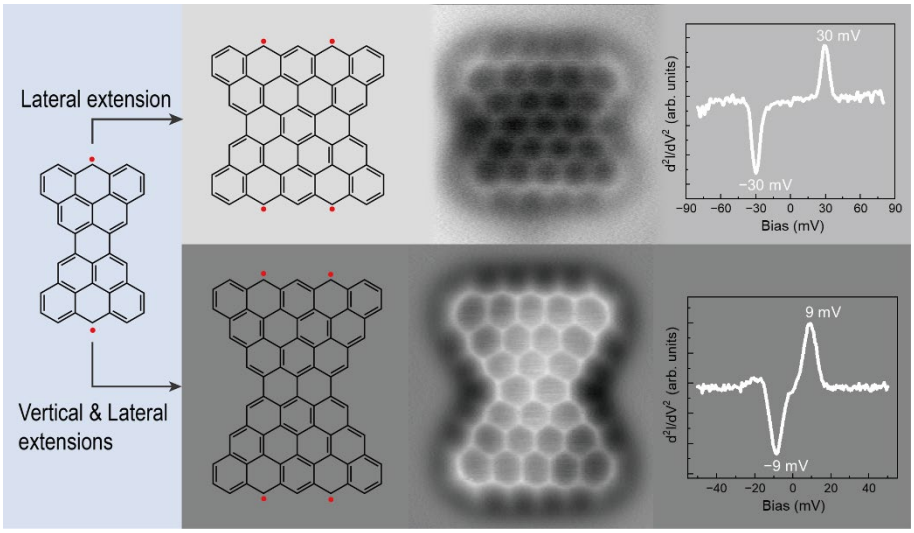
Polyradical nanographenes featuring strong spin entanglement and robust many-body spin states against external magnetic perturbations not only enable the exploration of correlated quantum magnetism at the molecular scale, but also constitute promising candidates for developing molecular qubits with chemical tunability and building scalable quantum networks. Here, we employed a predictive design strategy to achieve the on-surface synthesis of two homologues of Clar's goblet, $C_{62}H_{22}$ and $C_{76}H_{26}$, via lateral and vertical extensions of the parent structure, respectively. Both structures exhibit correlated tetraradical character and a many-body singlet ground state as confirmed by multireference theoretical calculations. These magnetic states arise from unique magnetic origins and also display distinct resilience to external perturbations, which can be experimentally validated using nickelocene-functionalized scanning probe techniques. Our work presents a general strategy for rational design of highly entangled polyradical nanographenes with tunable spin numbers and resilience of their many-body spin states to perturbations, opening exciting possibilities for exploring novel correlated spin phases in molecular systems and advancing quantum information technologies.



Reference

[1] E. Li, *et al*. arXiv:2506.05181 (2025)