

Prof. Dr. Jishan Wu

Full professor, National University of Singapore (NUS)

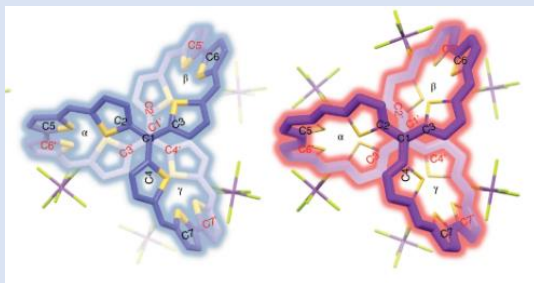
Curriculum vitae

- 1993 – 1997 BSc, **Wuhan** University
- 1997 – 2000 MSc, Chinese Academy of Sciences, **Beijing** with Prof. Xianhong Wang and Prof. Fosong Wang
- 2000 – 2004 PhD, Max Planck Institute of Polymer Research with Prof. Klaus Müllen, **Mainz**
- 2004 – 2005 Project leader, MPI-P, **Mainz**
- 2005 – 2007 Postdoc, University of California with Sir Fraser Stoddart, **Los Angeles**
- 2007 – 2011 Assistant Professor, NUS, **Singapore**
- 2011 – 2014 Associate Professor, NUS
- 2014 – 2017 Dean's Chair Professor, NUS
- from 2017 Full Professor, NUS



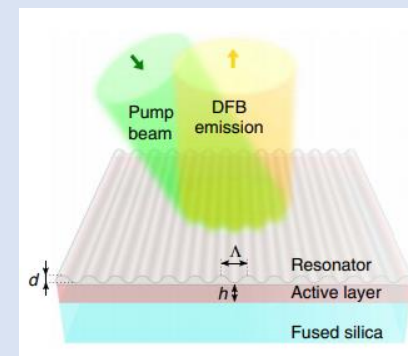
**280 publications,
17,700+ citations
H-Index: 66
> 25 PhD students**

Novel aromatic systems with interesting structures and properties



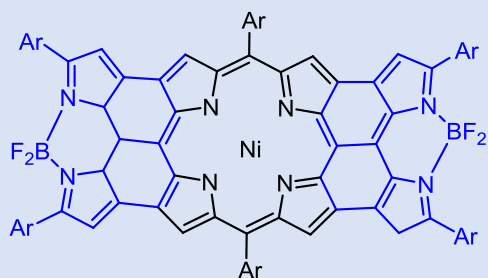
- Biradicaloids
- Global aromaticity

Device Engineering



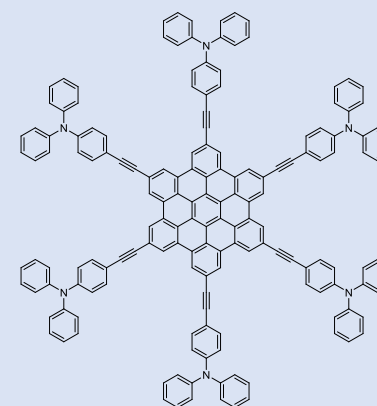
- Graphene composite electrodes
- Nanographene-based lasers

NIR dyes



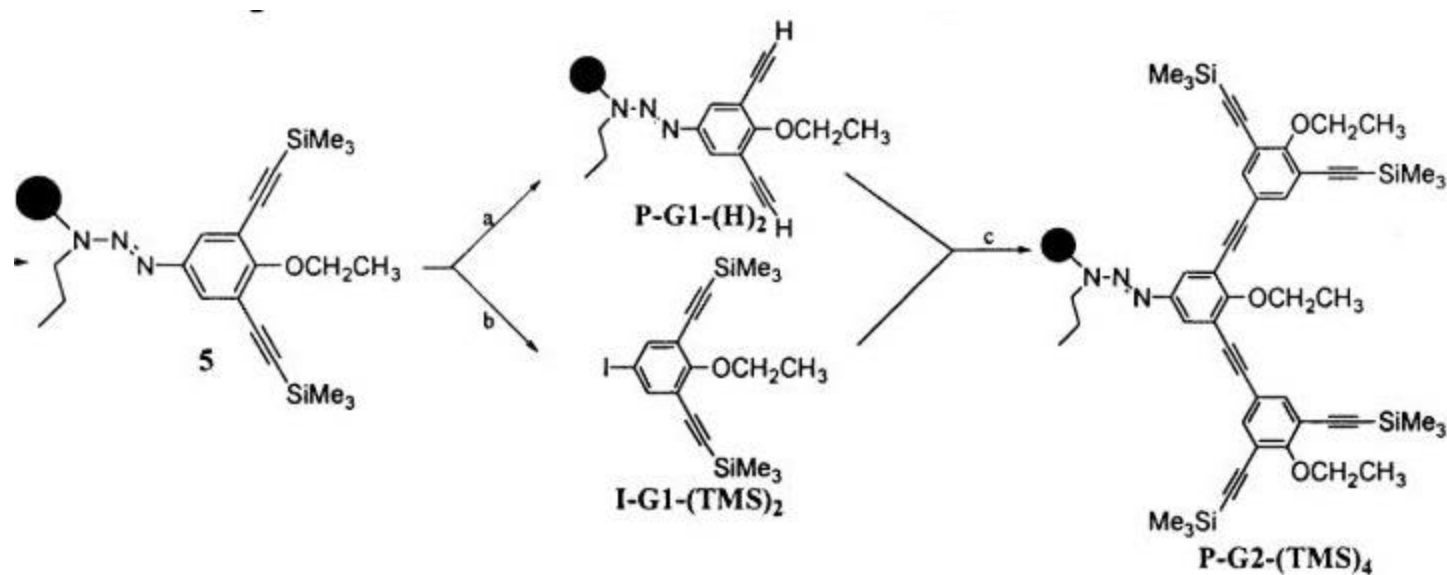
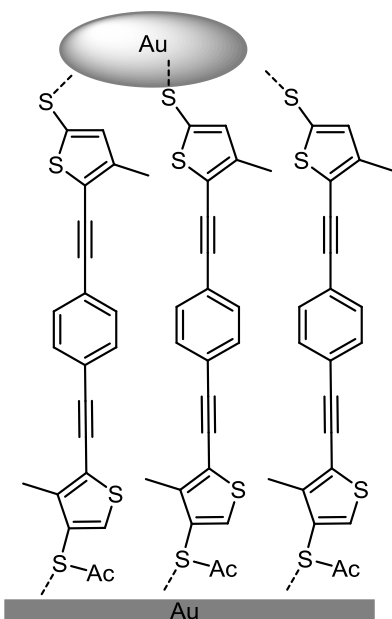
- BODIPY and porphyrine-based dyes
- Application in bio-imaging

Supramolecular Chemistry



- Aggregation and stacking of PHs
- Discotic mesogens

Focus already on polyaromatic systems and electrochemical applications



- Molecular wire monolayers on Au

Synth. Met. **2001**, *121*, 1269

Synth. Commun. **2000**, *30*, 4293

- Electroactive Phenylacetylene Dendrimers

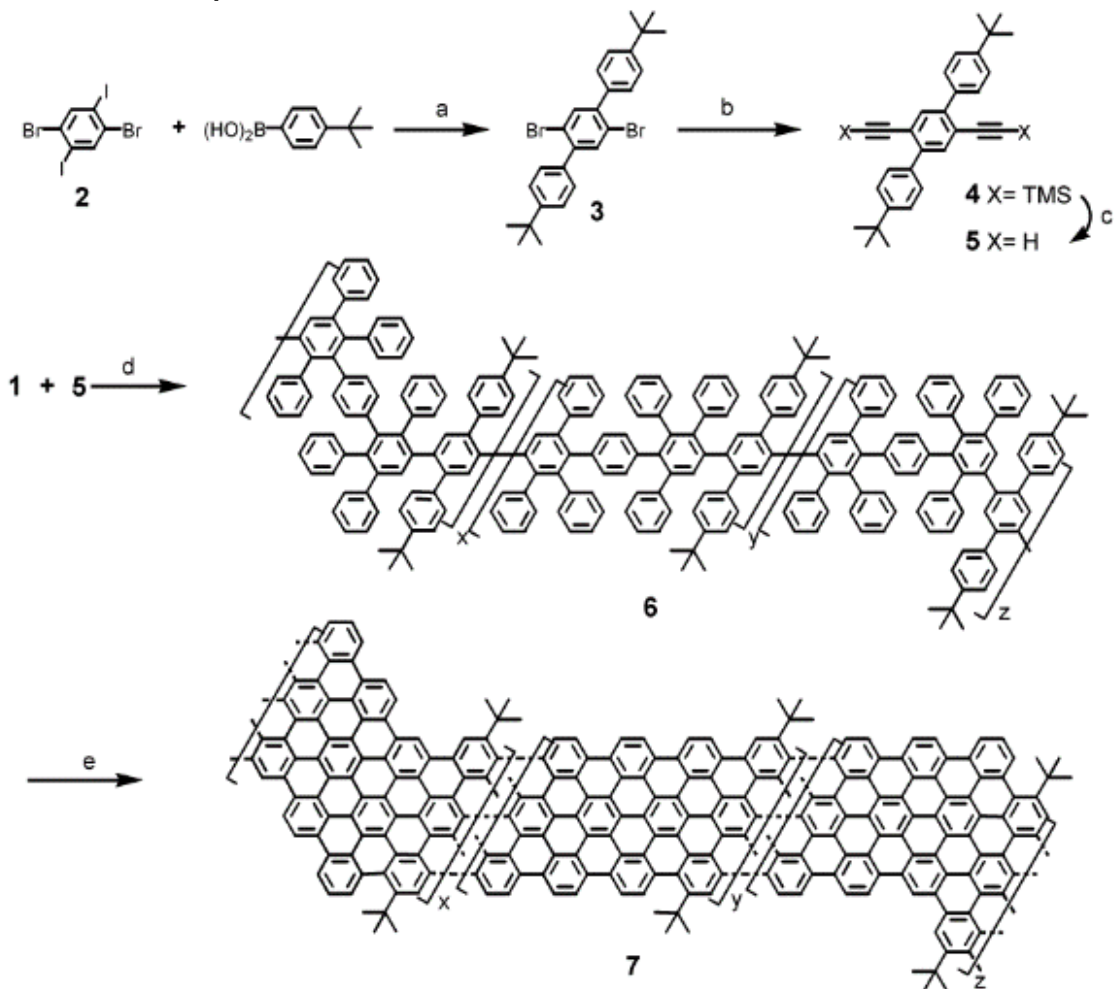
Macromolecules **2001**, *34*, 3812

Tetrahedron Lett. **2001**, *42*, 2181

Chin. Chem. Lett. **2001**, *12*, 387

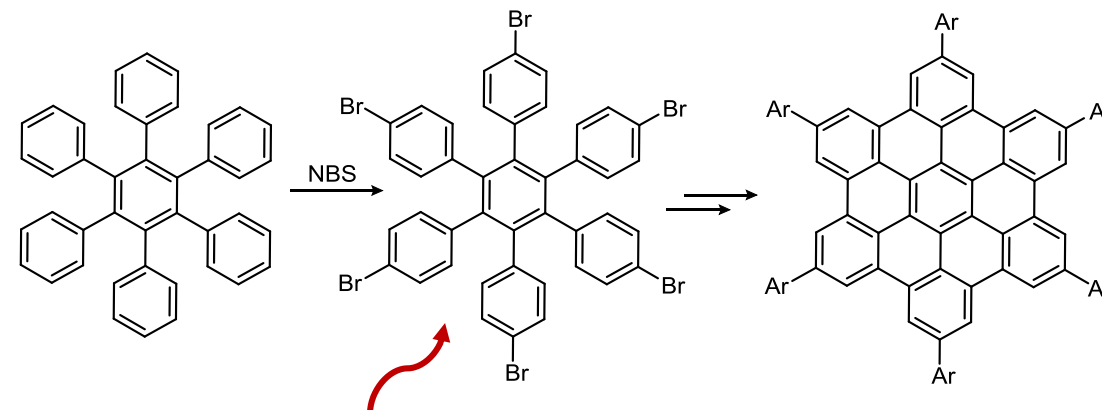
From Dendrimers to Polycyclic Hydrocarbons

- A Graphene Nanoribbon



Macromolecules **2003**, *36*, 7082

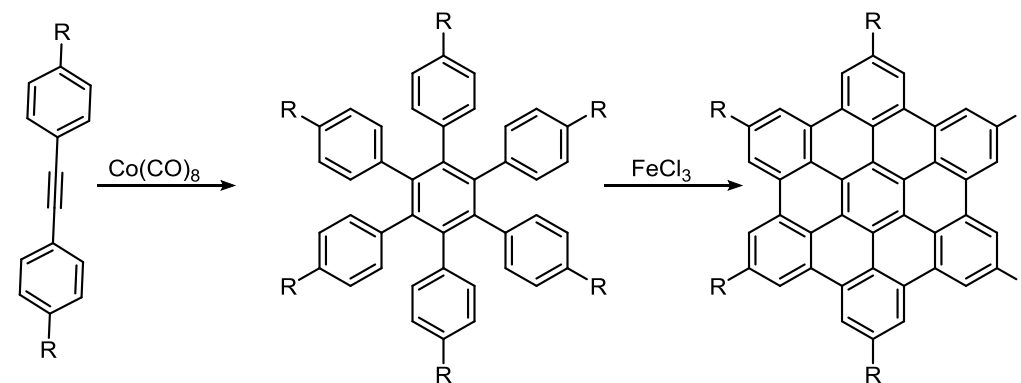
- A new synthetic route to HBCs



Versatile functionalization possible

Angew. Chem. Int. Ed. **2003**, *42*, 5329
J. Am. Chem. Soc. **2004**, *126*, 177

Previously by Müllen: Not compatible with heteroatoms

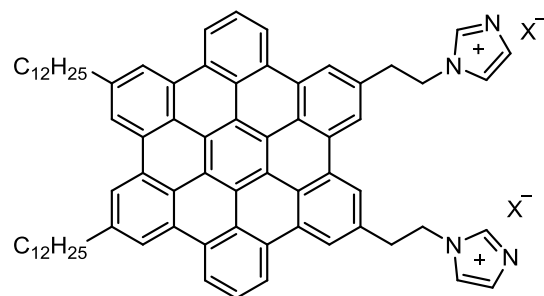


Stabel, A.; Herwig, P.; Müllen, K.
Angew. Chem. Int. Ed. **1995**, *34*, 1609

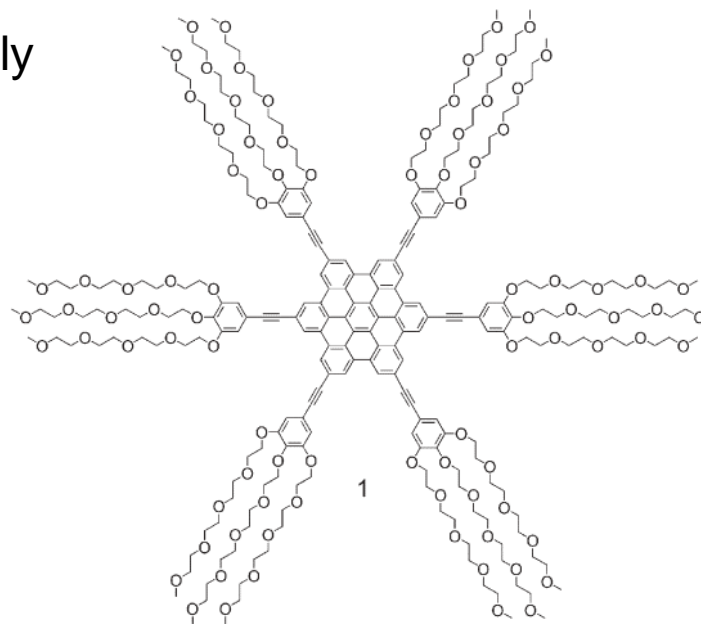
Hexa-*peri*-hexabenzocoronenes

- synthetic routes
- analogues
- supramolecular chemistry and self-assembly
- applications as liquid crystalline material

- Self-assembly of amphiphilic HBC



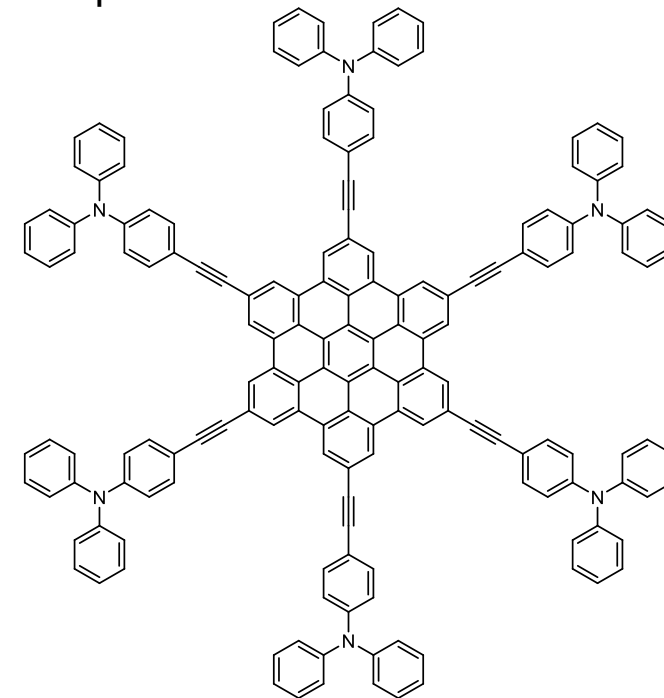
Chem. Commun. **2007**, 2384



- Water-soluble HBC as template for porous silica

Chem. Commun. **2006**, 48

- Hole-transport material



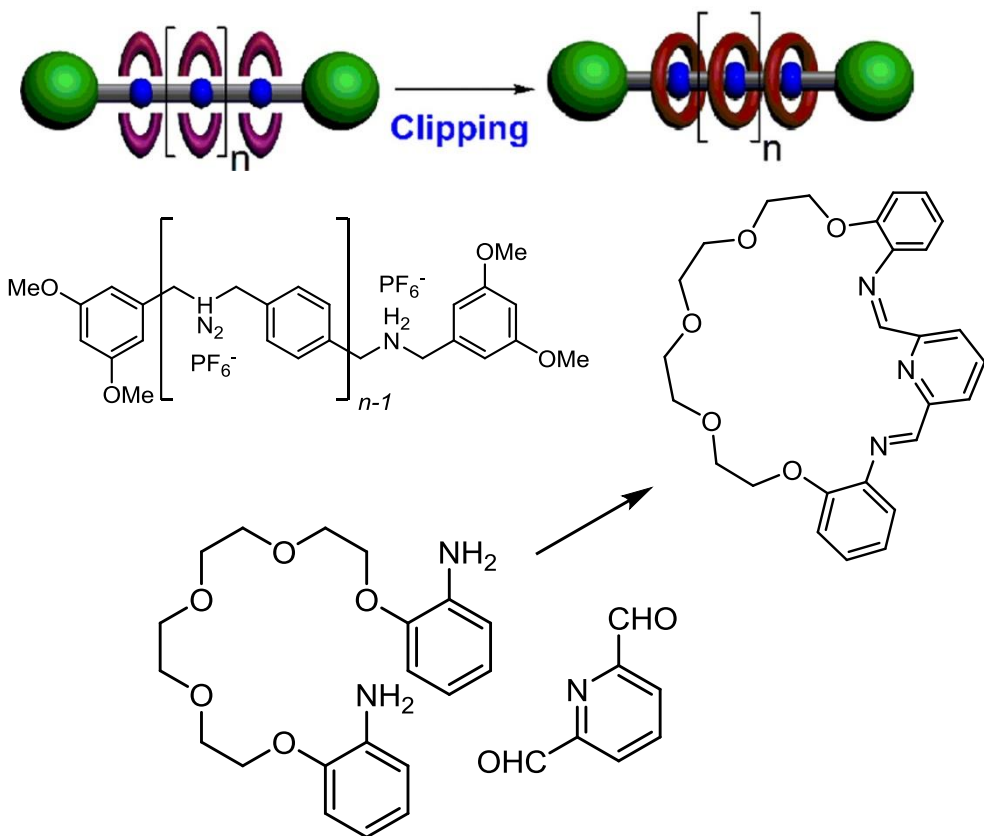
Angew. Chem. Int. Ed. **2004**, 43, 5331

Impressive output

44 publications with Klaus Müllen
in less than 5 years

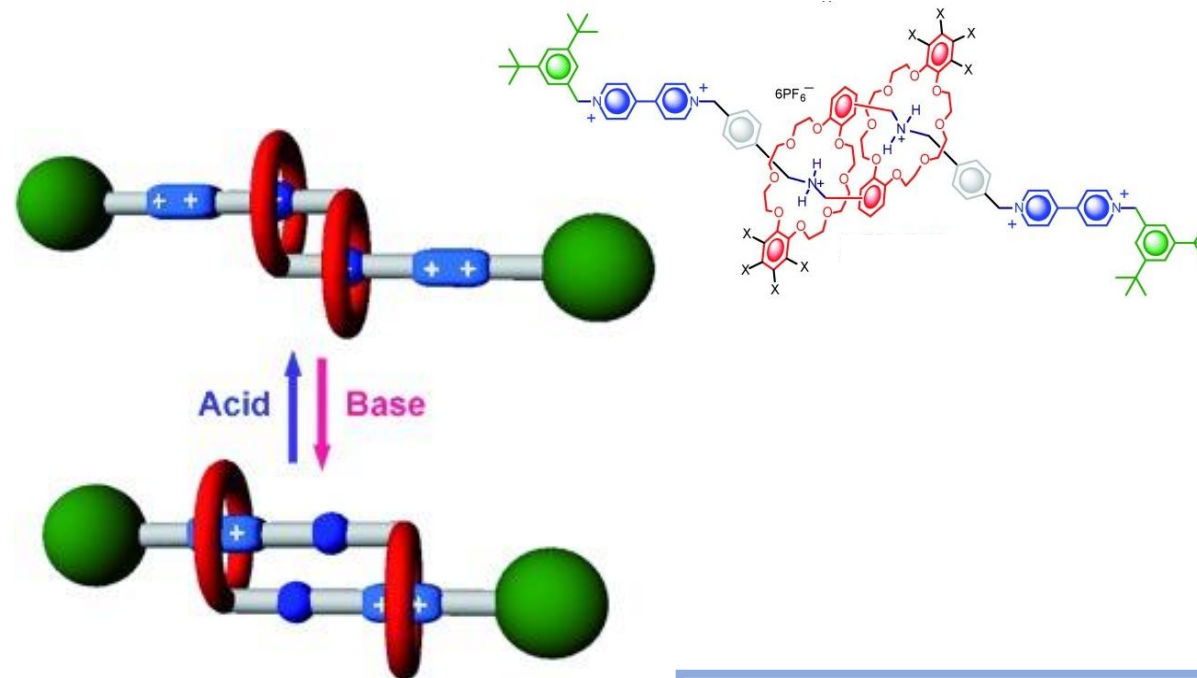
A shift in gear: Making novel rotaxanes

- Making Rotaxanes by clipping reaction



Proc. Nat. Acad. Sci. **2007**, *104*, 17266

- Rotaxane Daisy chain \rightarrow molecular muscle

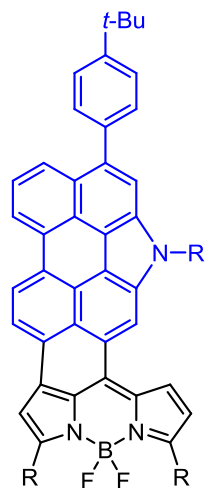


Angew. Chem. Int. Ed. **2008**, *47*, 7470

Inspired by his work with Stoddard, Wu occasionally published rotaxanes and catenanes until 2013

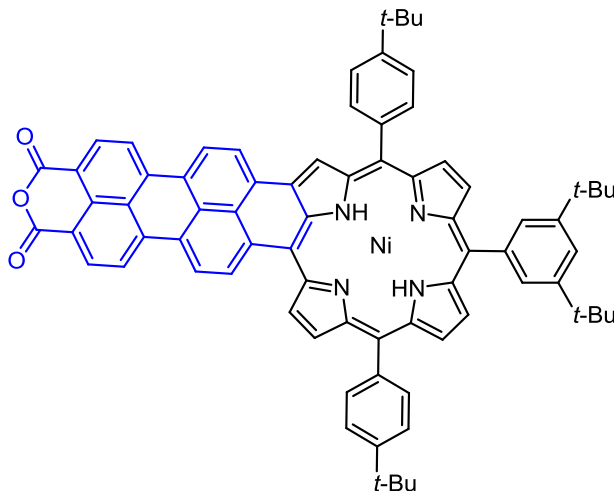
Combining polycyclic hydrocarbons and heterocycles

- Perilene-fused BODIPY

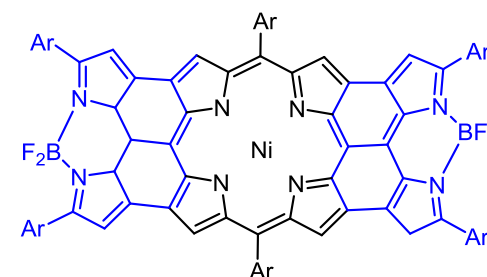


Org. Lett. **2011**, *13*, 632

- for dye-sensitized solar cells



Org. Lett. **2011**, *13*, 14, 3652

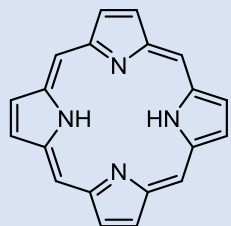


Chem. Eur. J. **2011**, *17*, 6610

Applications

- Bio imaging
- NIR laser protection
- Solar cells

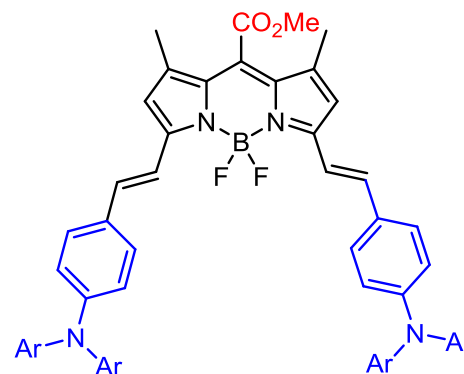
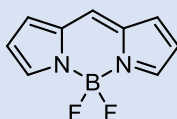
Porphyrins



fluorescent dyes
highly tunable

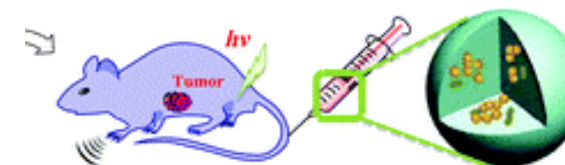
BODIPYs

(boron-dipyrromethene)



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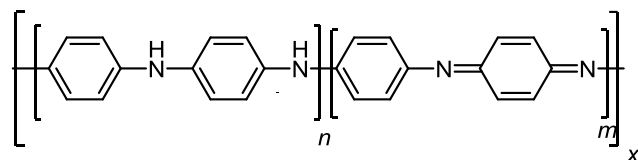
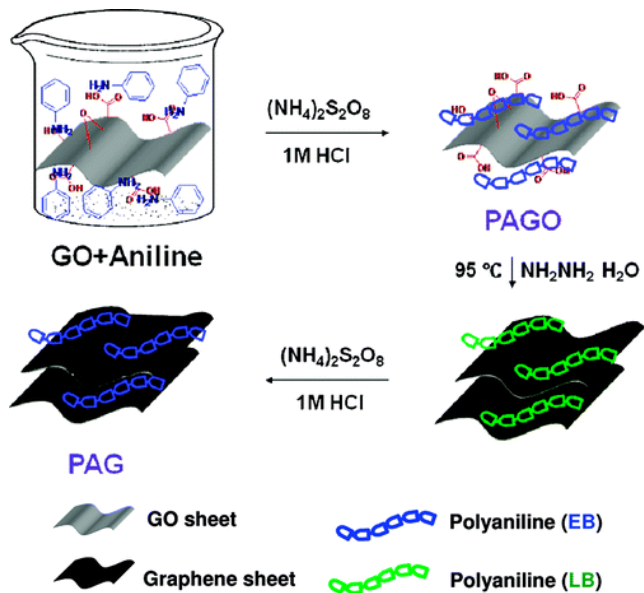
- Push-pull type BODIPY for photoacoustic imaging



Org. Biomol. Chem. **2017**, *15*, 4531

- Electrode material from Graphene/Polyaniline Nanofiber Composites

Most cited paper of Wu
<1695 citations!



- Stabilization by surfactant improves capacitor performance

- Graphene/MnO₂ composites for supercapacitor electrodes

J. Mater. Chem. **2012**, *22*, 1845

- Graphene Oxide/ Resorcinol-formaldehyde resin composite

J. Mater. Chem. **2011**, *21*, 2663

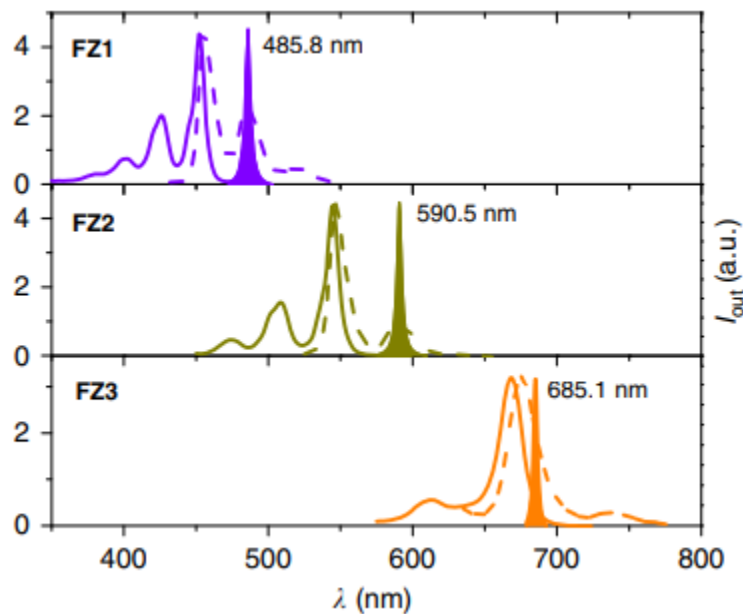
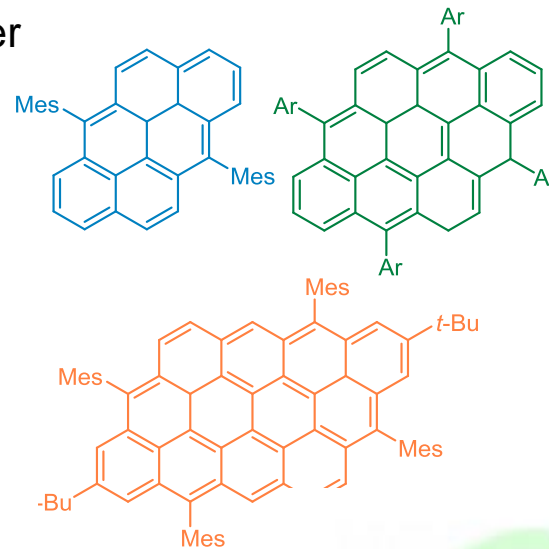
- Graphene/silicon composites for Li-battery anodes

Carbon **2011**, *49*, 1787

Chem. Mater. **2010**, *22*, 4, 1392

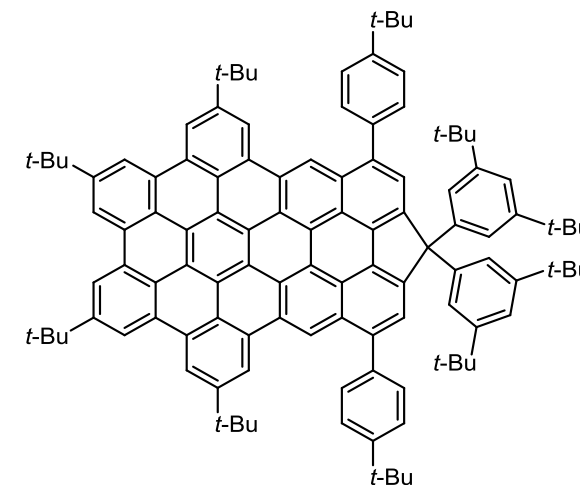
J. Mater. Chem. **2012**, *22*, 80

- PHs dispersed in polystyrene thin film for distributed feedback laser

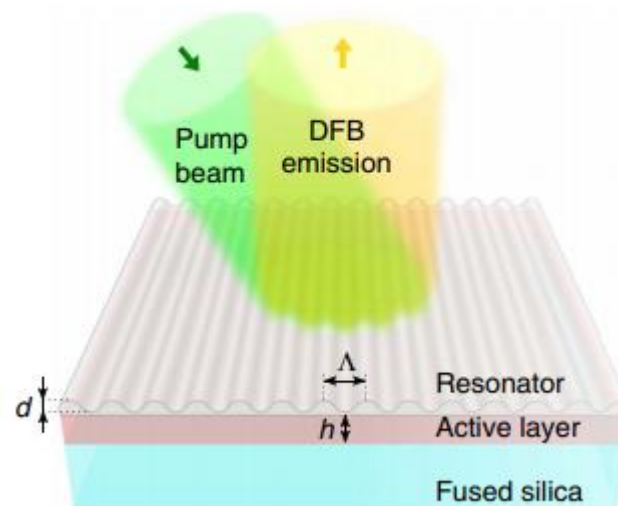


Nat. Commun. **2019**, *10*, 3327

- High photoluminescence quantum yield:
 - zig-zag edge
 - prevents aggregation



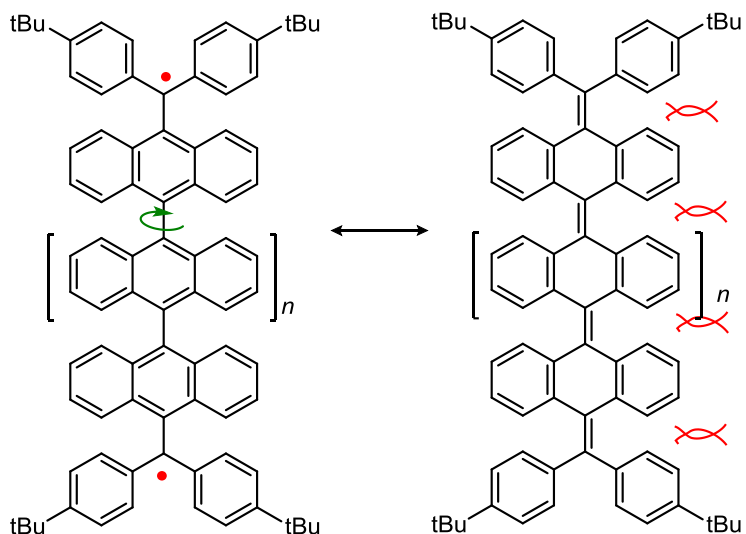
Angew. Chem. Int. Ed. **2020**
EARLY VIEW



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Discovering the electronic structure of PHs

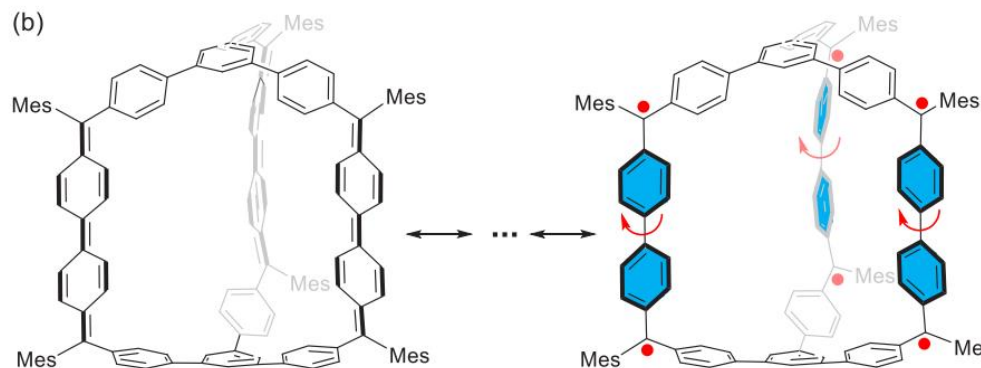
- Aromatic stabilization vs steric strain release
- Biradicaloid character increases with size of scaffold



- n = 0: closed-shell, quinoidal
 1: triplet biradical
 2: triplet biradical
- Strain increases with size

Chem. Eur. J. **2015**, *21*, 18724

- Structural rigidity lowers biradicaloid character



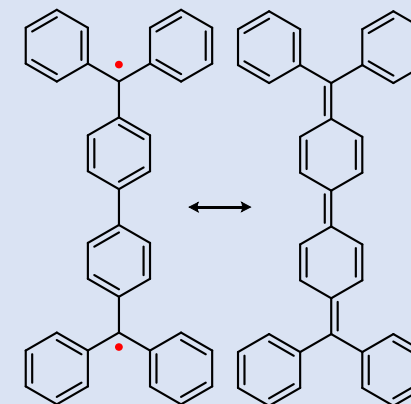
J. Am. Chem. Soc. **2020**, *142*, 29, 12730

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Biradicals

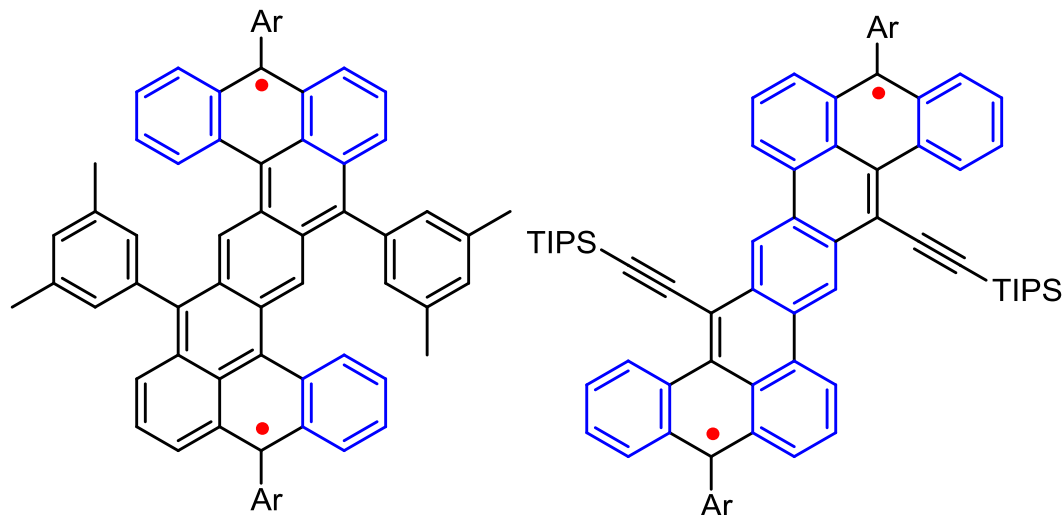
even-electron compound
 with 2 independent free
 radicals

Chichibabin's hydrocarbon



- Biradicaloid character to retain Clar sextets
- Reactive and unstable

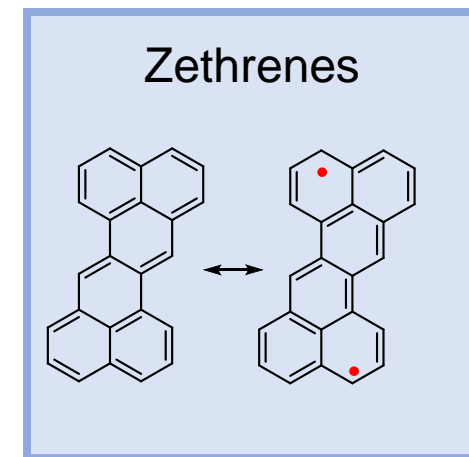
- Stabilization with Clar-sextets determines biradicaloid character



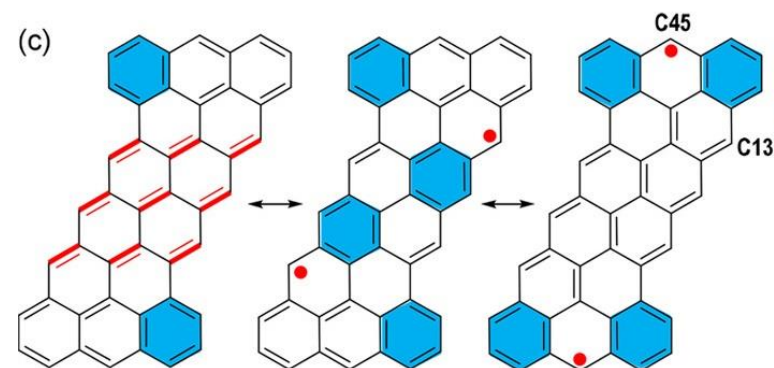
3 Clar Sextets
 $y = 0.309$

4 Clar Sextets
 $y = 0.576$

J. Am. Chem. Soc. **2013**, *135*, 18229

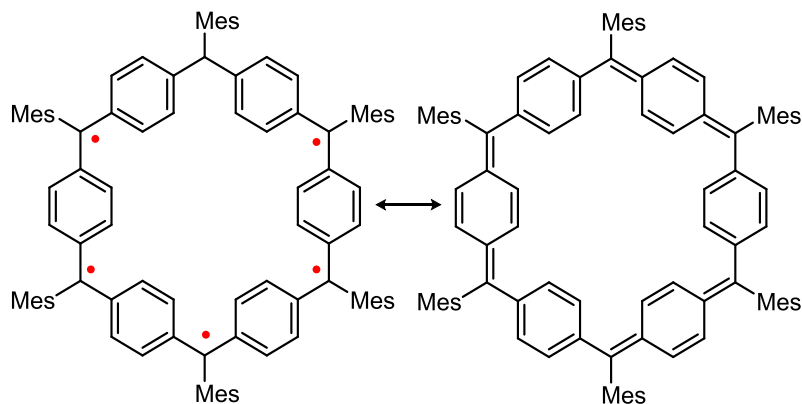


- Biradicaloid character increases with size of scaffold

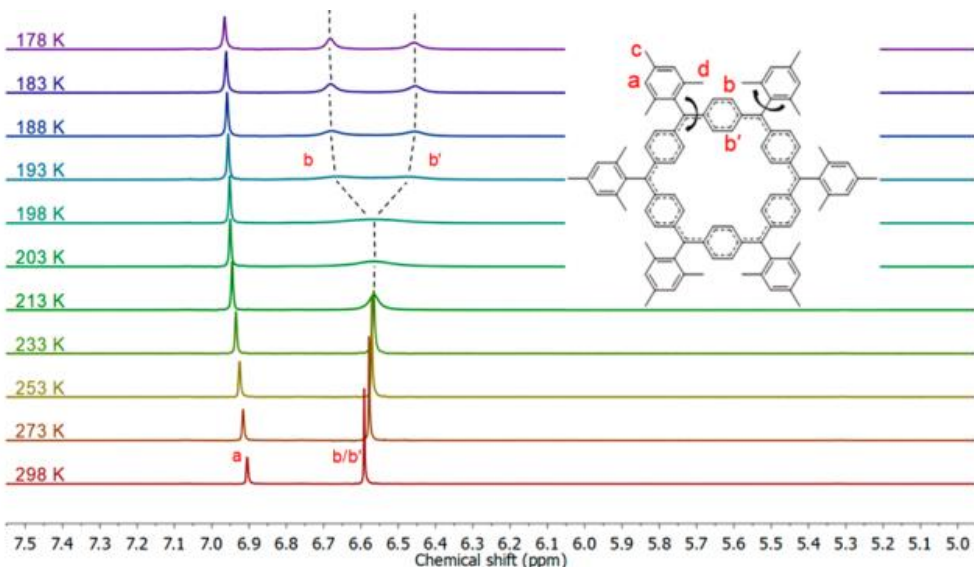


J. Am. Chem. Soc. **2018**, *140*, 14054

- „Super-benzene“
Global aromatic 30 π conjugation pathway

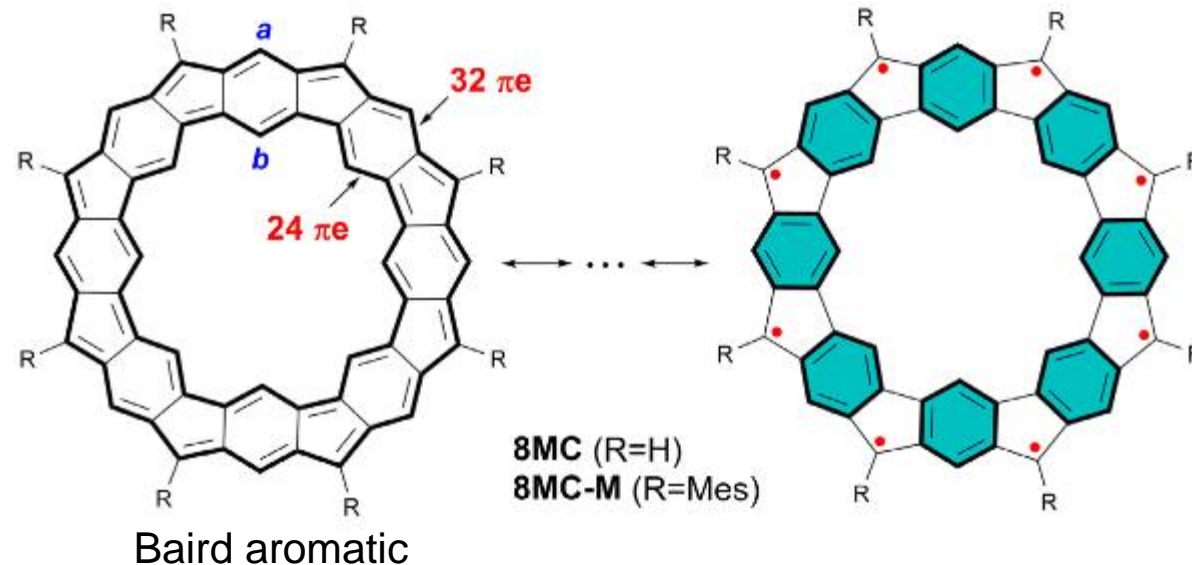


Global aromaticity affects NMR-shift along conjugation pathway



J. Am. Chem. Soc. **2019**, *141*, 41, 16266

- Annulene within annulene



Inner and outer conjugation pathway affect different NMR-shift

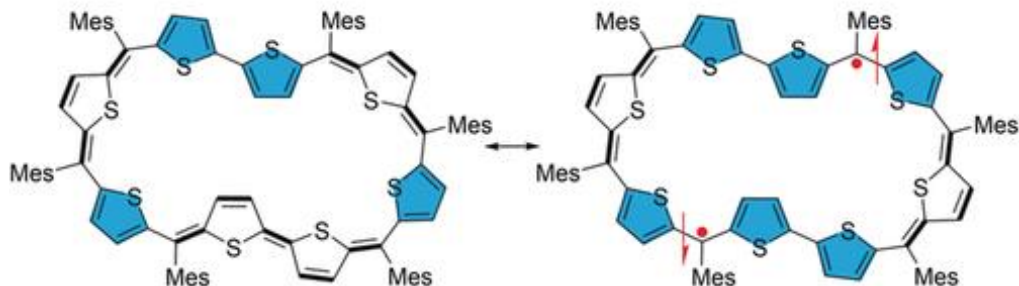
Chem **2018**, *4*, 1586

Hückel aromatic
[4n+2] πe^-

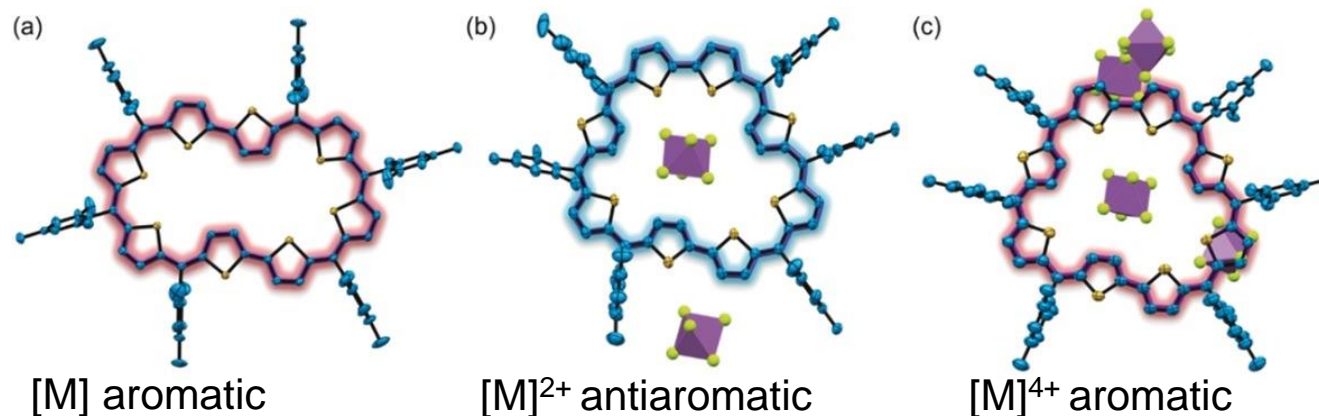
Baird aromatic
In T1 state:
[4n] πe^-

Möbius aromatic
In Möbius strip:
[4n] πe^-

- A globally aromatic thiophene-based macrocycle

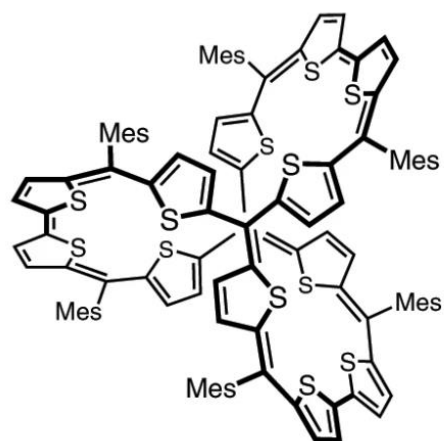


Angew. Chem. Int. Ed. **2020**, *59*, 59, 7414

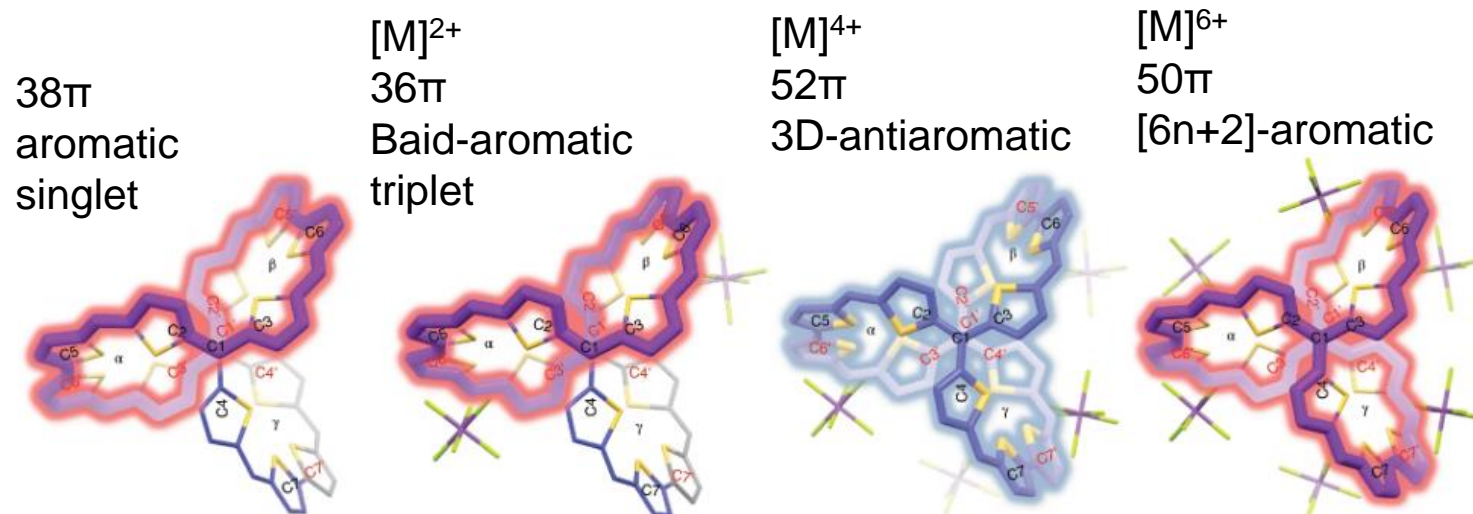


Oxidation affects change in geometry and aromaticity

- 3D Aromaticity

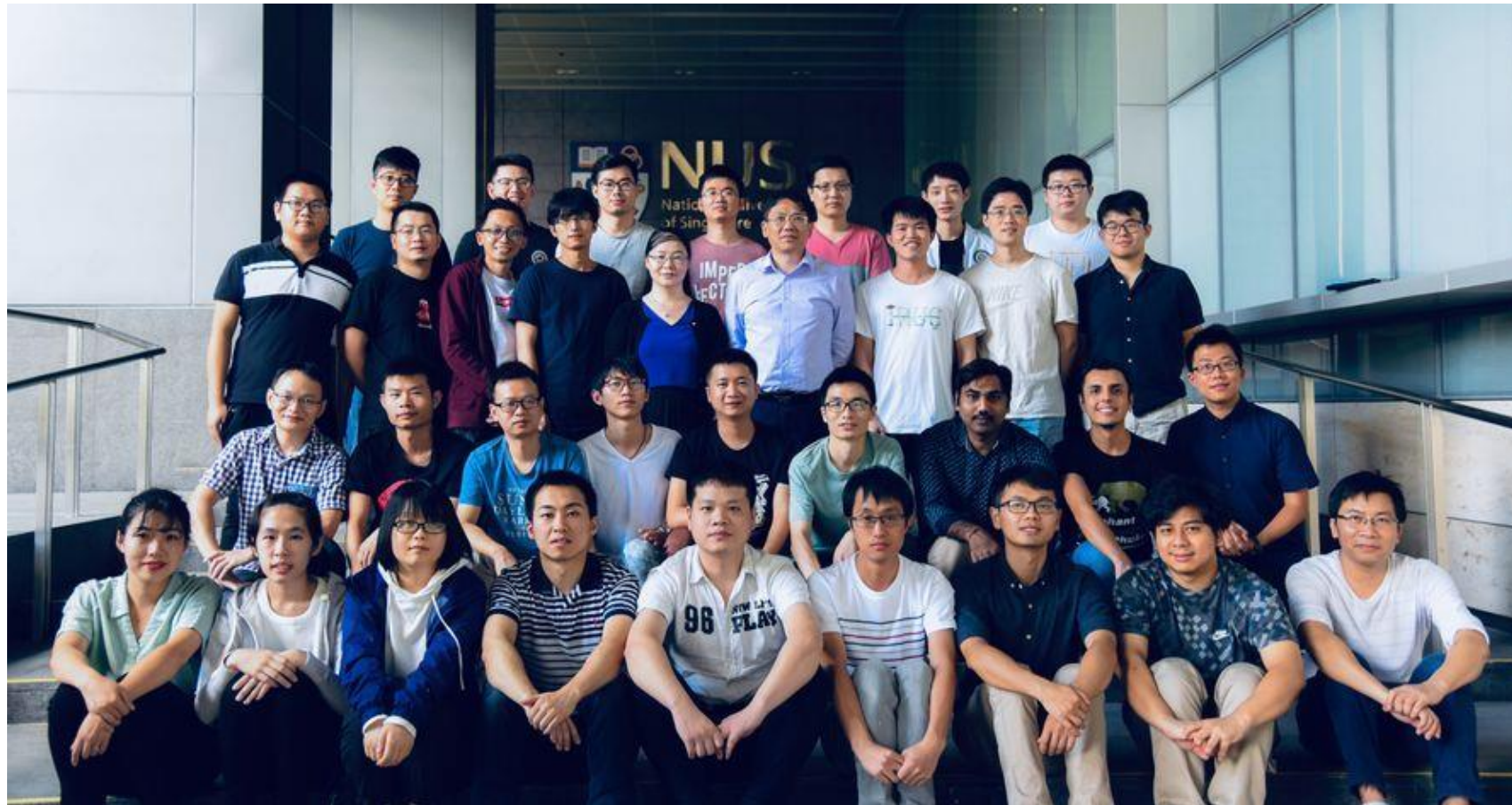


Nat. Chem. **2020**, *12*, 242



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Wu Lab 2019



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