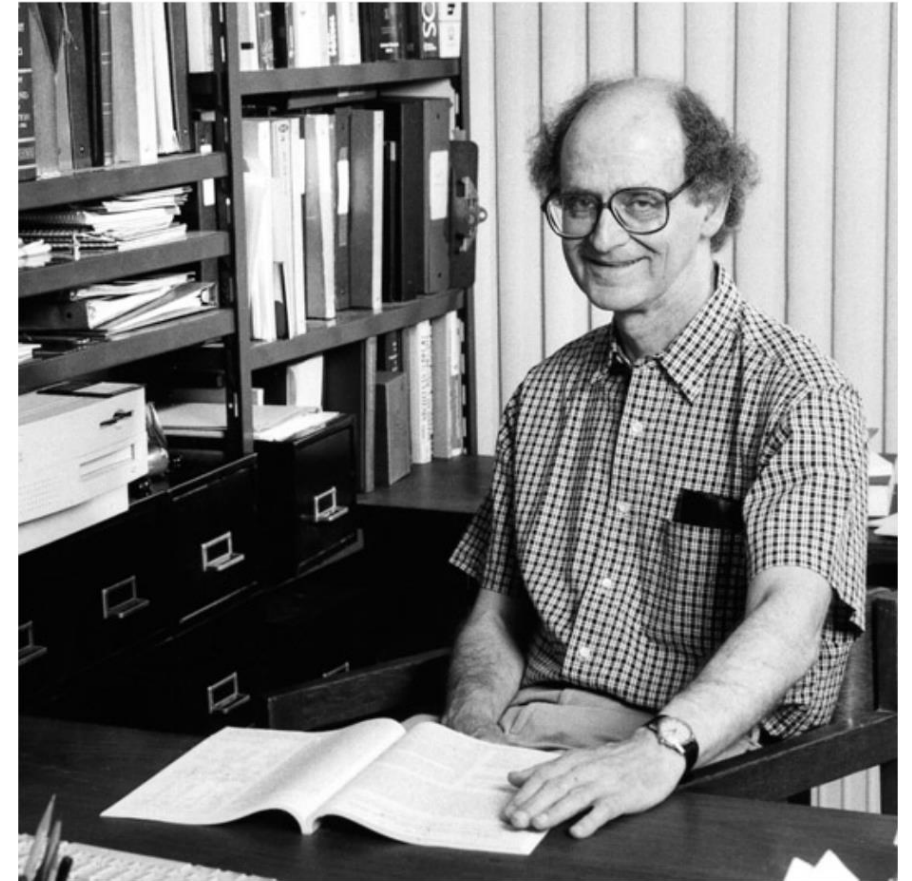


Prof. Dr. A. Thomas J. Katz
emeritus professor Columbia University

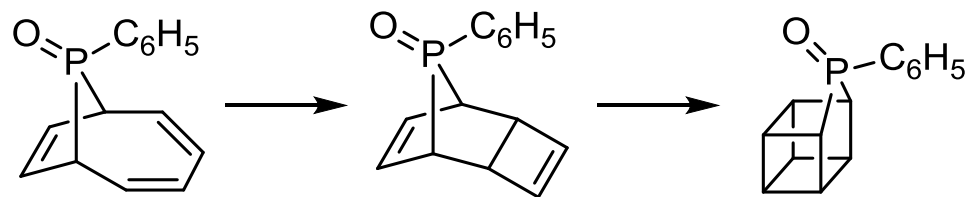
- B. A., University of Wisconsin, 1956
- M. A., Harvard University, 1957 (Prof. R. B. Woodward)
- Ph.D., Harvard University, 1959 (Prof. R. B. Woodward)

- 1959–1961 Instructor, Columbia University
- 1961–1964 Assistant Professor, Columbia University
- 1964–1968 Associate Professor, Columbia University
- 1965 Visiting Associate Professor, University of California, Berkeley
- 1968–2009 Professor, Columbia University
- 1988 Visiting Professor, University of Konstanz, Germany
- 2009 Professor Emeritus, Columbia University

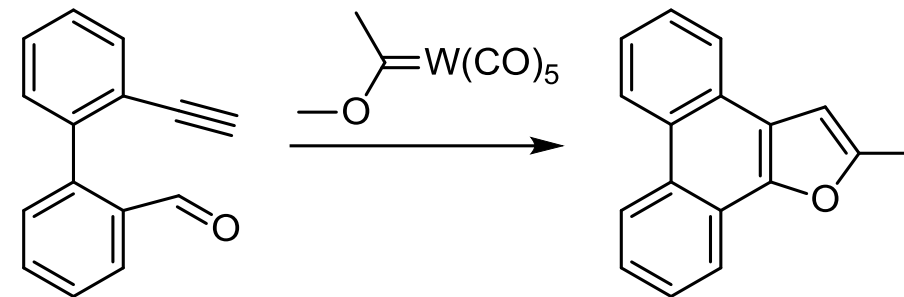
- > 163 publications
- h-index: 58



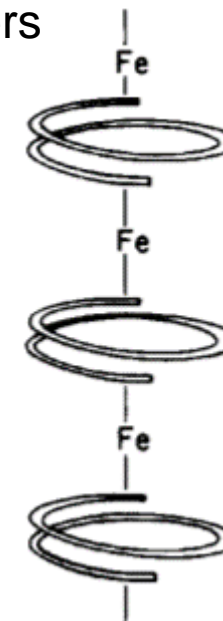
- Application of cycloadditions and pericyclic reactions for the synthesis of complex molecules



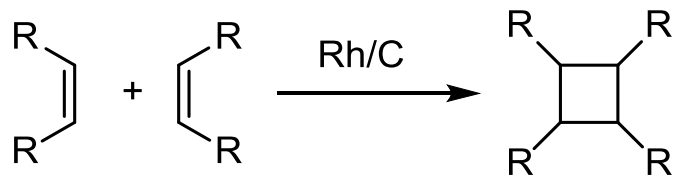
- Olefin metathesis



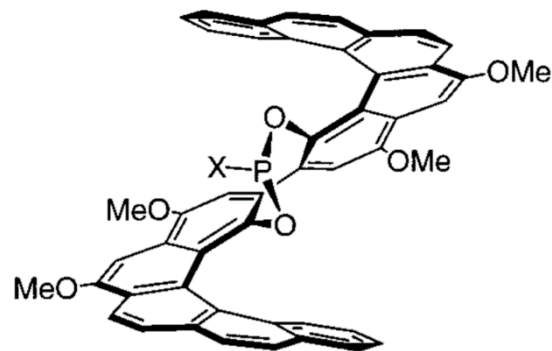
- Synthesis and investigation of metallocenes and metallocene polymers



- Rh catalyzed cycloaddition and mechanistic studies



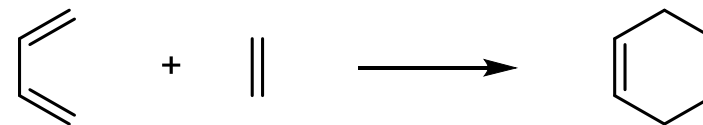
- Synthesis and application of helicenes



- First publication: Free Energy Functions for Gaseous Atoms from Hydrogen (Z= 1) to Niobium (Z=41)

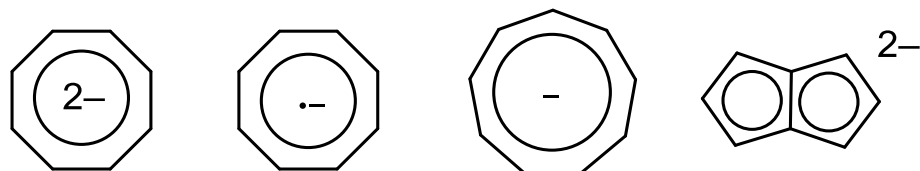
Katz, T. J.; Margrave, L. M. *J. Chem. Phys.* **1955**, *23*, 983.

- Mechanistic studies of Diels–Alder reactions



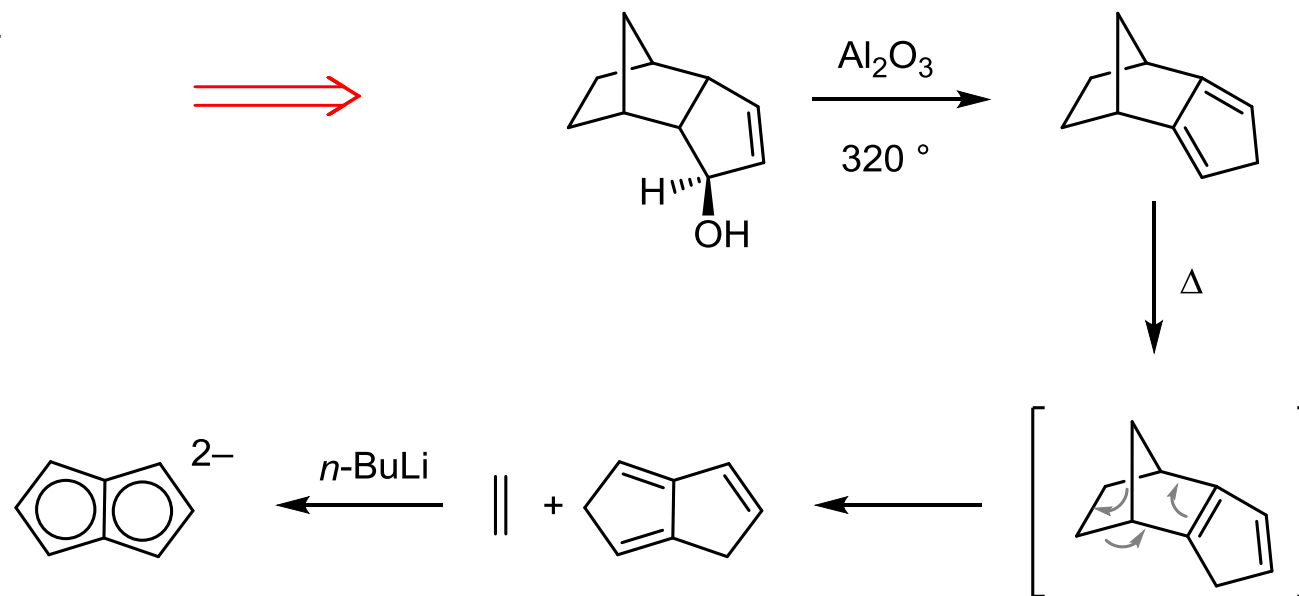
Woodward, R. B.; and Thomas J. Katz, T. J. *Tetrahedron* **1959**, *5*, 70.

- 10π aromatic systems



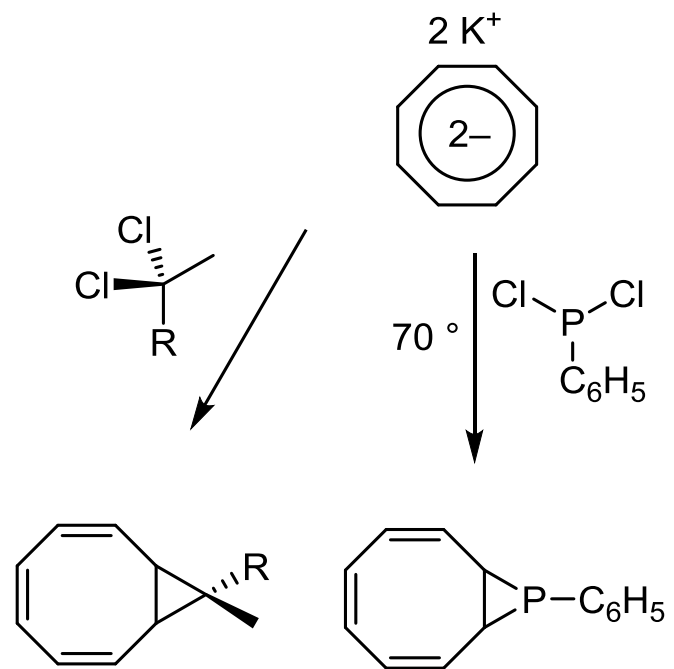
Katz, T. J.; *J. Am. Chem. Soc.* **1960**, *82*, 3784.

Katz, T. J.; Garratt, P. J. *J. Am. Chem. Soc.* **1963**, *85*, 2852.



Katz, T. J.; Rosenberger, M.; O'Hara, R. K. *J. Am. Chem. Soc.* **1964**, *86*, 249.

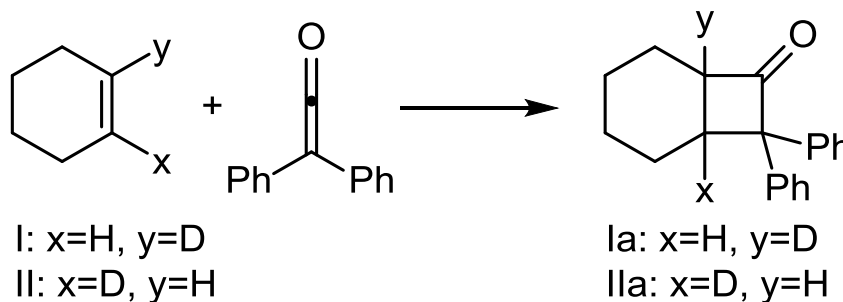
- Application of aromatic anions in organic synthesis



Katz, T. J.; Garratt, P. J. *J. Am. Chem. Soc.* **1964**, 86, 4876.

Katz, T. J.; Nicholson, C. R.; Reilly, C. A. *J. Am. Chem. Soc.* **1966**, 88, 3832.

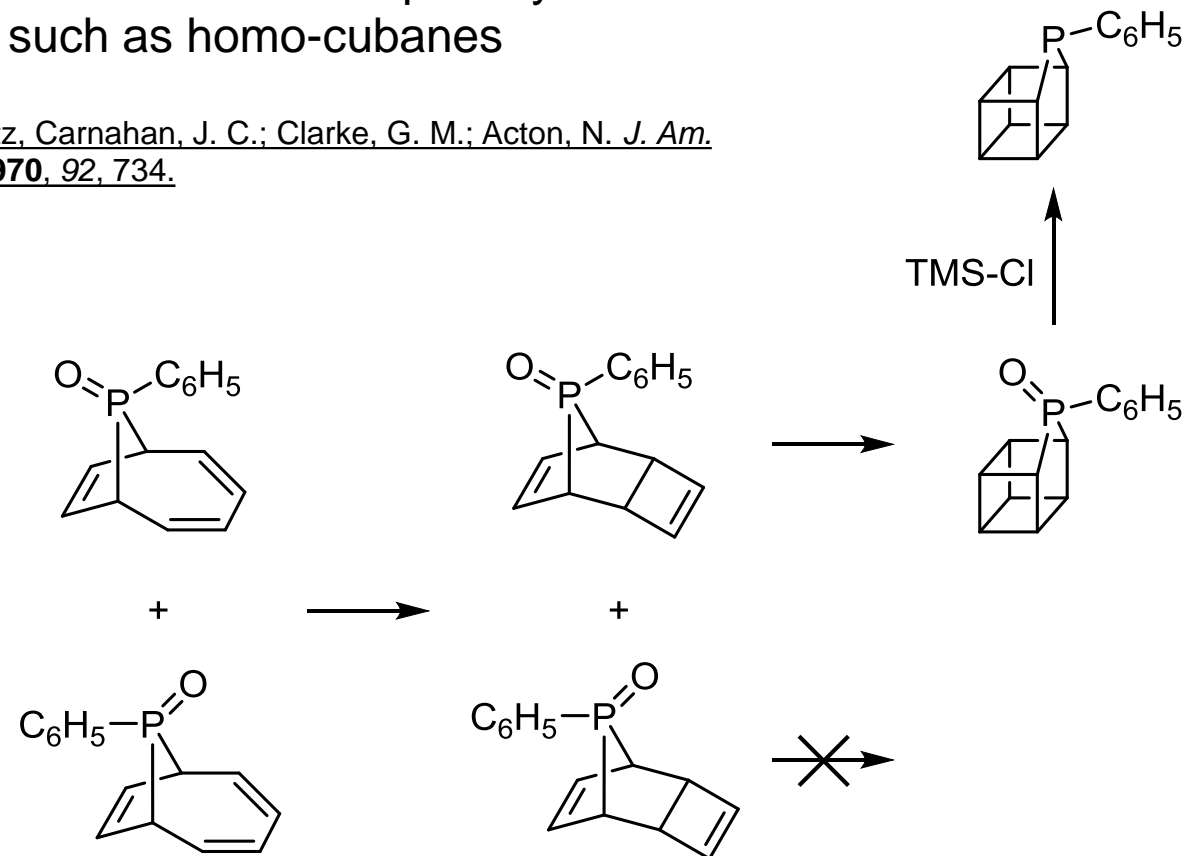
- Secondary kinetic isotope effect as a tool for the analysis of reaction mechanisms



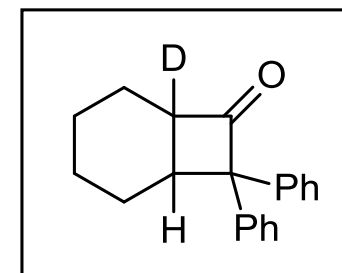
Katz, T. J.; Dessau, R. *J. Am. Chem. Soc.* **1963**, 85, 2172.

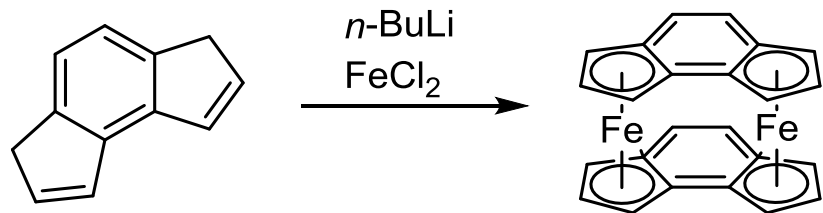
- Short route to complex hydrocarbons such as homo-cubanes

Thomas J. Katz, Carnahan, J. C.; Clarke, G. M.; Acton, N. *J. Am. Chem. Soc.* **1970**, 92, 734.

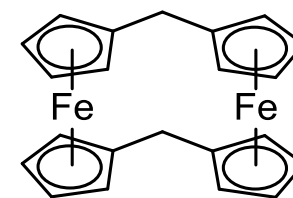
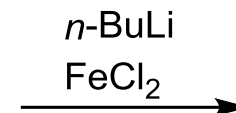
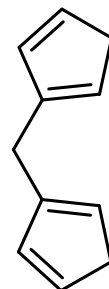


Favored:

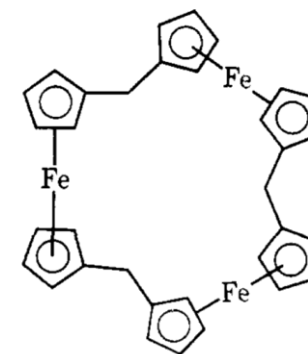




Katz, T. J.; Schulman, J. *J. Am. Chem. Soc.* **1964**, *86*, 3169.



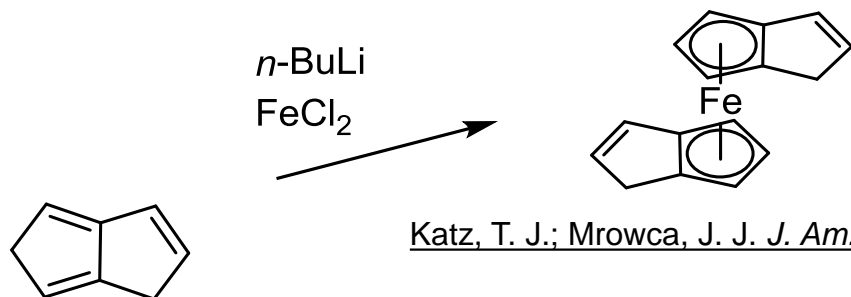
+



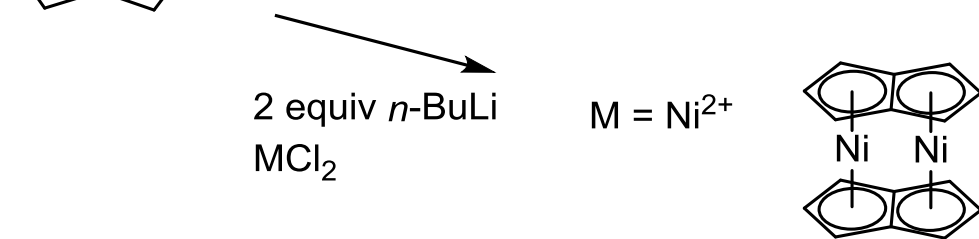
Katz, T. J.; Acton, N.; Martin, G. *J. Am. Chem. Soc.* **1969**, *91*, 2804.

+ tetramer
+ pentamer

- Pentalene sandwich complexes:

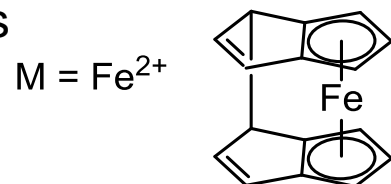


Katz, T. J.; Mrowca, J. *J. Am. Chem. Soc.* **1967**, *89*, 1105.



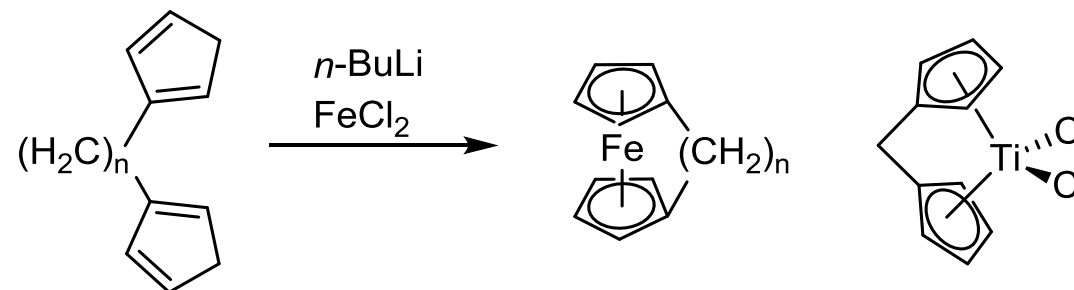
Katz ; T. J.; Acton, N. *J. Am. Chem. Soc.* **1972**, *94*, 3281.

- By using CoCl_2 both types of structures can be achieved



Katz, T. J.; Acton, N.; McGinnis, J. *J. Am. Chem. Soc.* **1972**, *94*, 6205.

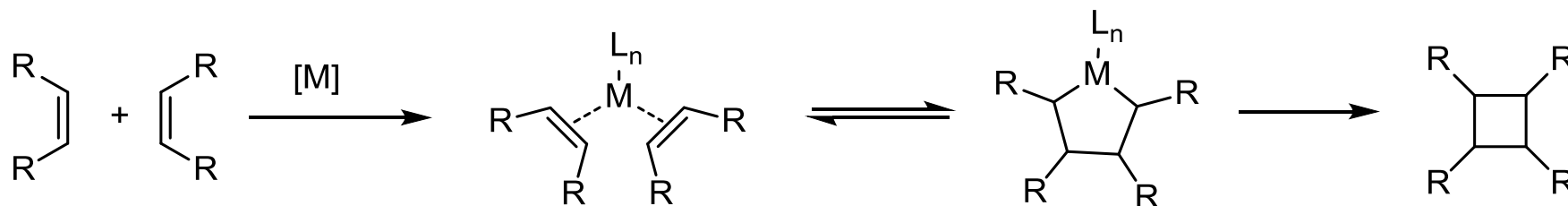
- Bridged metallocenes:



Katz, T. J.; Acton, N.; Martin, G. *J. Am. Chem. Soc.* **1973**, *95*, 2934.

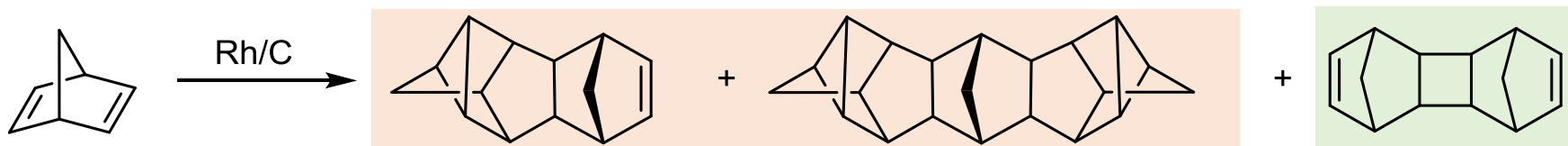
Katz, T. J.; Ślusarek, W. *J. Am. Chem. Soc.* **1979**, *101*, 4259.

- General mechanism:

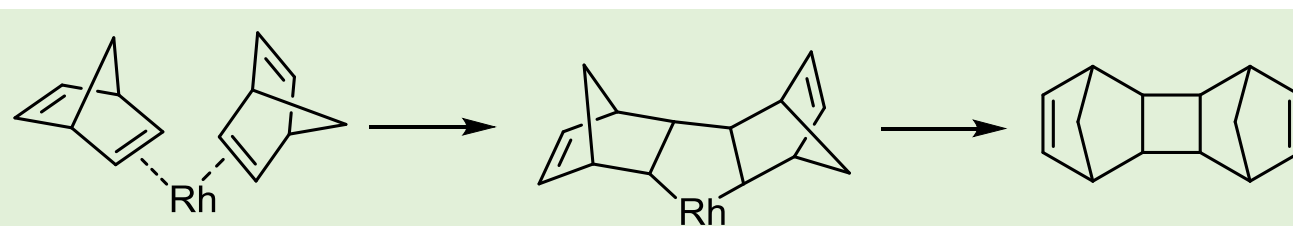
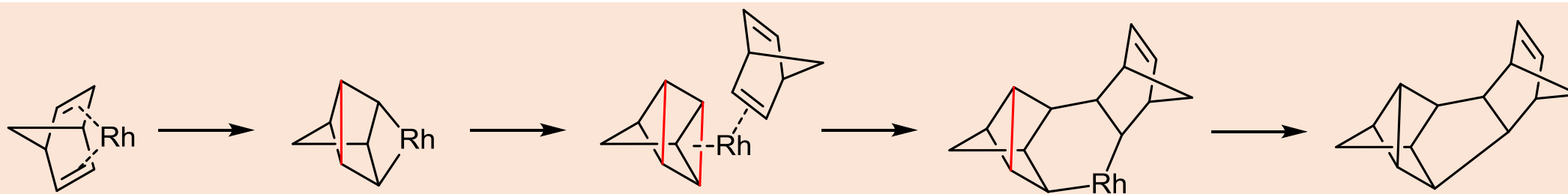


A brief summary on metal-catalyzed [2+2] cycloadditions:

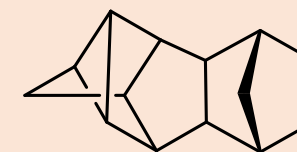
Parthasarathy, K.; Cheng, C. H. *Comprehensive Organic Synthesis II*, 5, 2014, 222.



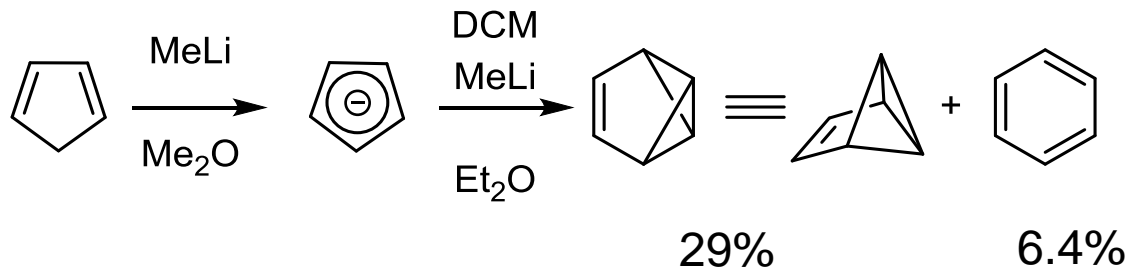
Mrowca, J. J.; Katz, T. J. *J. Am. Chem. Soc.* **1966**, 88, 4012.



≡



- First (high yielding) synthesis of benzvalene



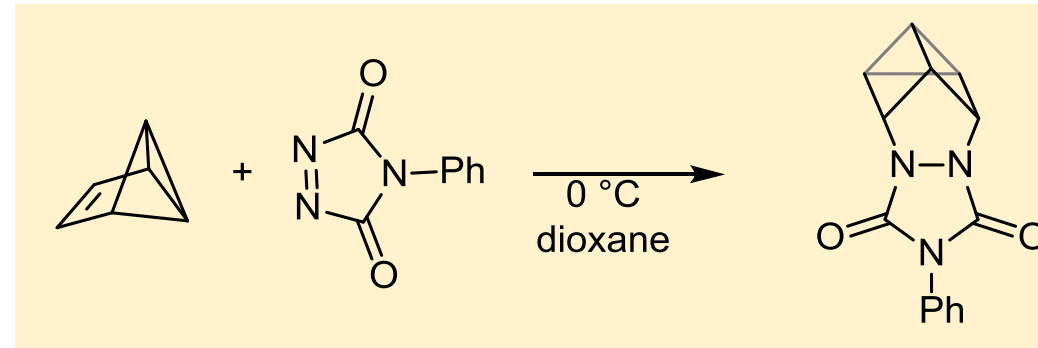
Katz, T. J.; Wang, E. J.; Acton, N. J. *Am. Chem. Soc.* **1971**, *93*, 3782.

- Old route: irradiation of benzene with light gave 0.05% yield (1% if the mixture was diluted in hexadecane)

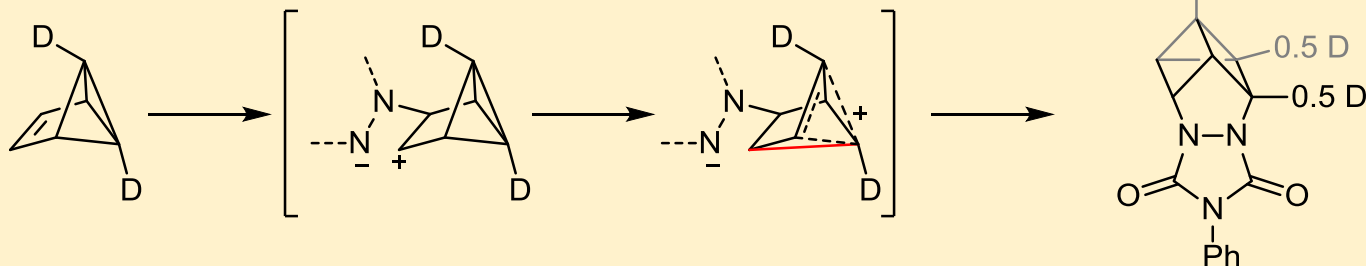
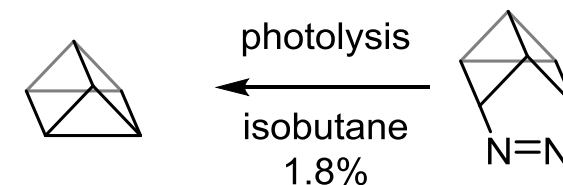
Wilzbach, K. E.; Ritscher, J. S.; Kaplan, L. *J. Am. Chem. Soc.* **1967**, *89*, 1031.

Katz, T. J.; Acton, N. "Synthesis of Prismane," *J. Am. Chem. Soc.* **1973**, *95*, 2738.

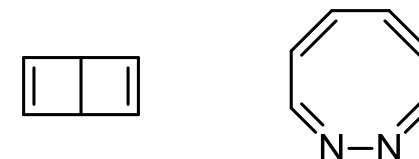
- A subsequent synthesis of prismane



KOH
reflux
MeOH/H₂O



- Other relevant molecules produced:



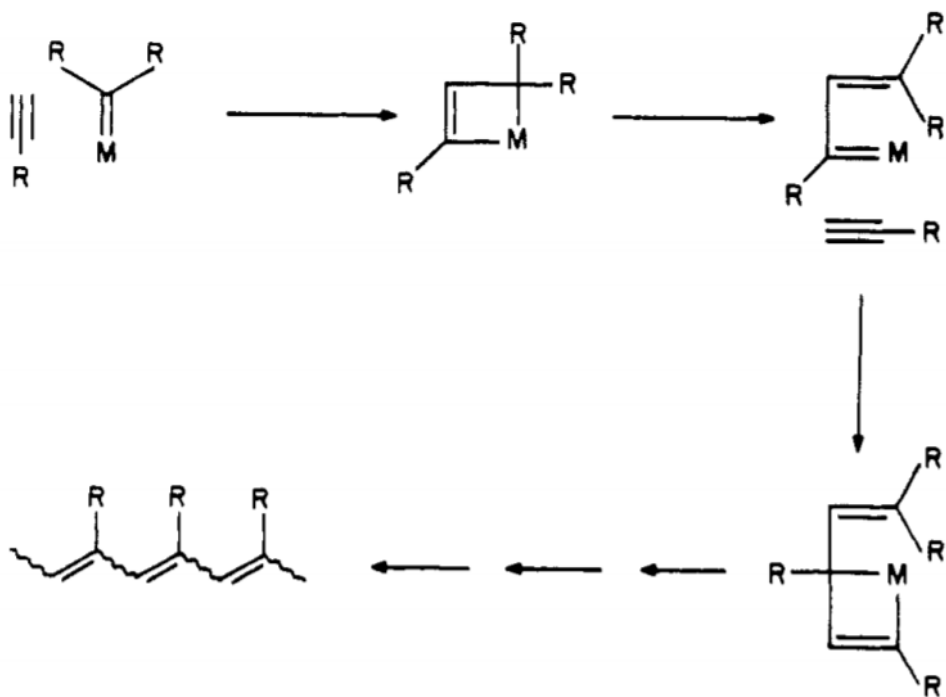
Turro, N. J.; Renner, C. A.; Waddell, W. H.; Katz, T. J. *J. Am. Chem. Soc.* **1976**, *98*, 4320.

- Studies on the reaction mechanism of olefin metathesis reported by Hérrison and Chauvin

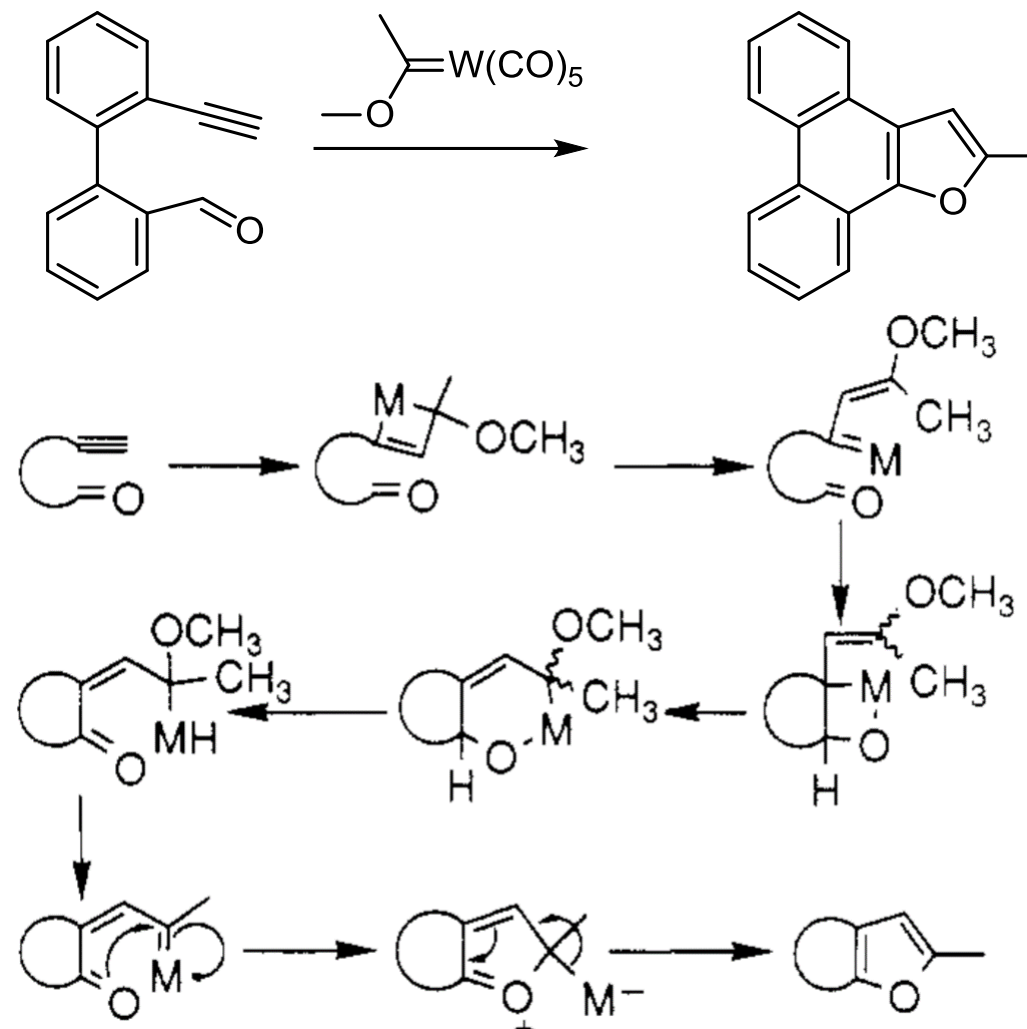
Katz, T. J.; McGinnis, J. J. *Am. Chem. Soc.* **1975**, *97*, 1592.

- His own description on these findings can be found:
<http://www.columbia.edu/cu/chemistry/fac-bios/katz/group/pages/publications.html#top> (Section XI)

- Procedure for building-up polymers

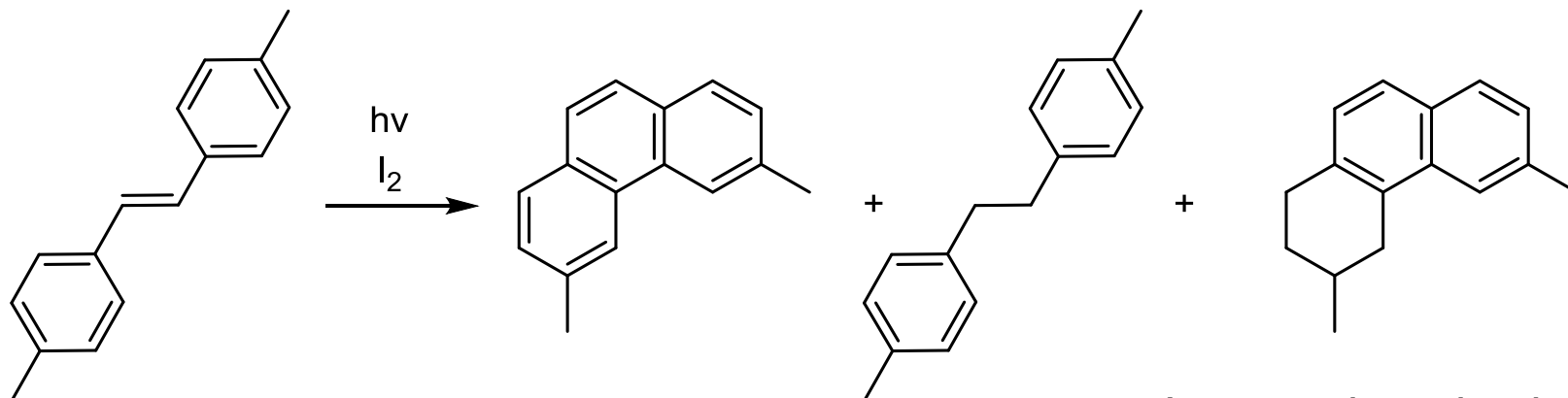


Han, C.-C.; Katz, T. J. *Organometallics* **1985**, *4*, 2186.



Sivavec, T. M.; Katz, T. J.; Chiang, M. Y.; Yang, G. X.-Q. *Organometallics* **1989**, *8*, 1620.

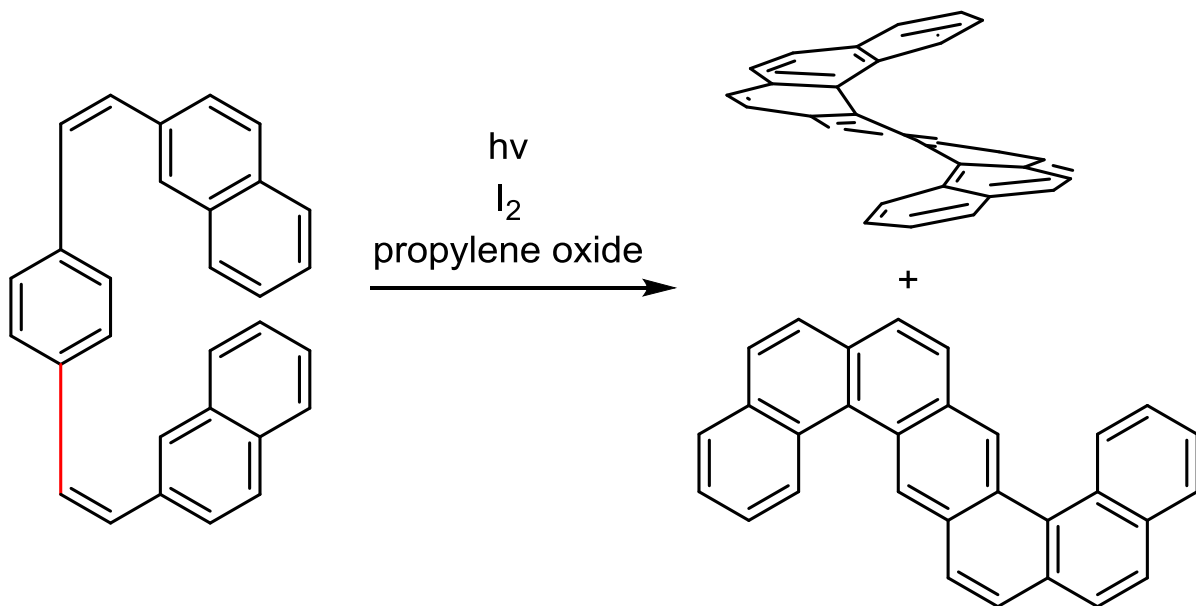
- Side reactions during photocyclization



Liu, L.; Yang, B.; Katz, T. J.; Poindexter, M. K. *J. Org. Chem.* **1991**, *56*, 3769.

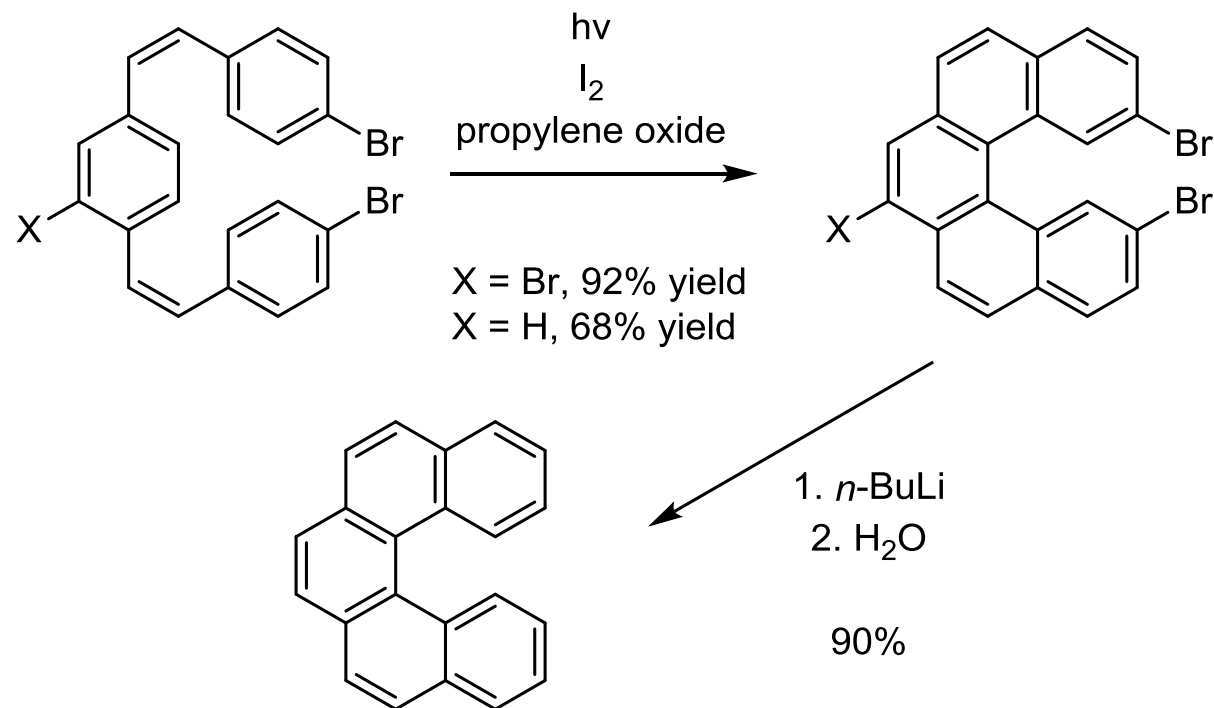
Liu, L.; Katz, T. J. *Tetrahedron Lett.* **1991**, *32*, 6831.

- Rotational problems:

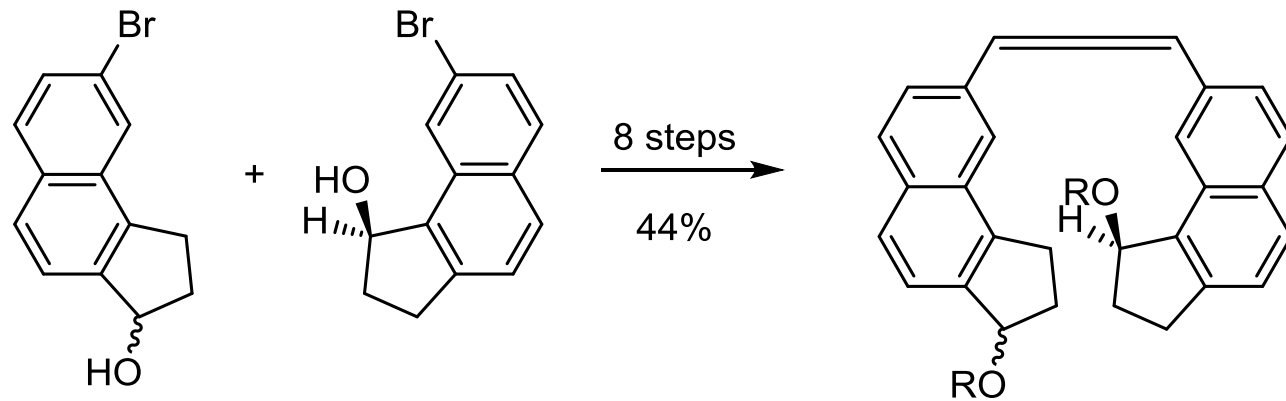


Sudhakar, S.; Katz, T. J. *Tetrahedron Lett.* **1986**, *27*, 2231.

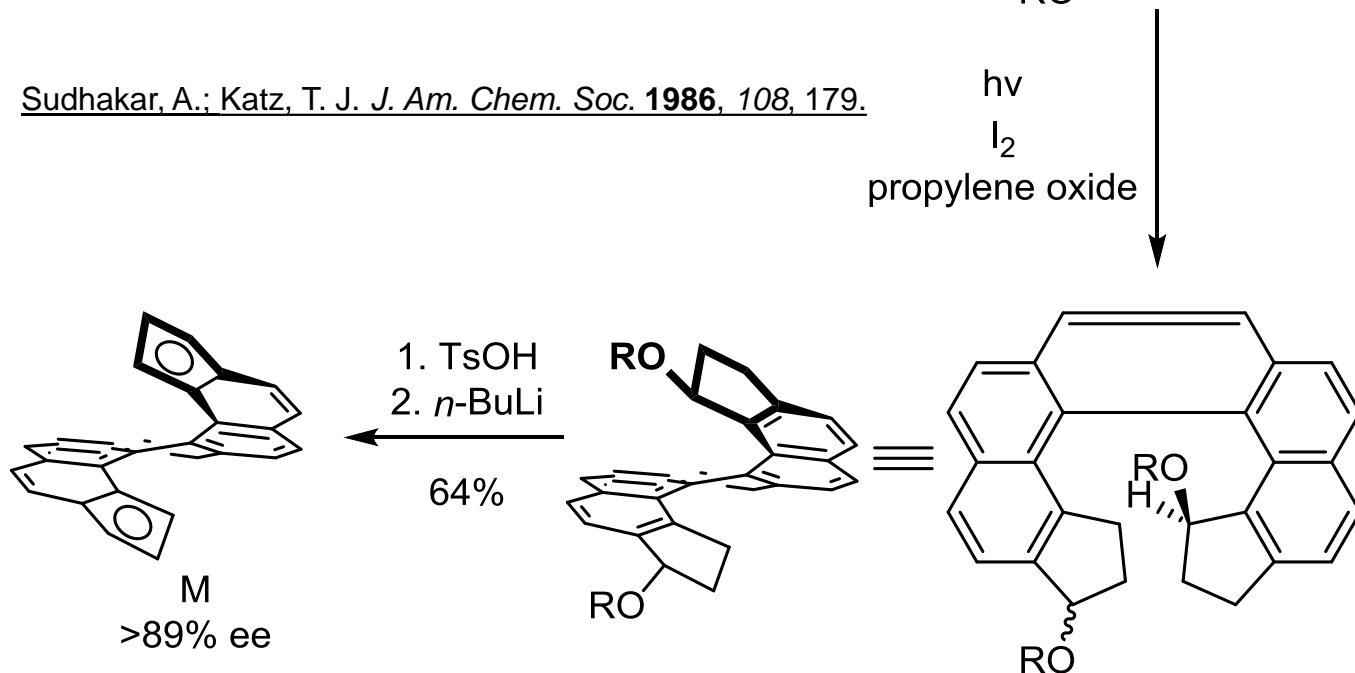
- Improved synthesis: bromine auxiliaries



- Winding of the helix is controlled by R groups



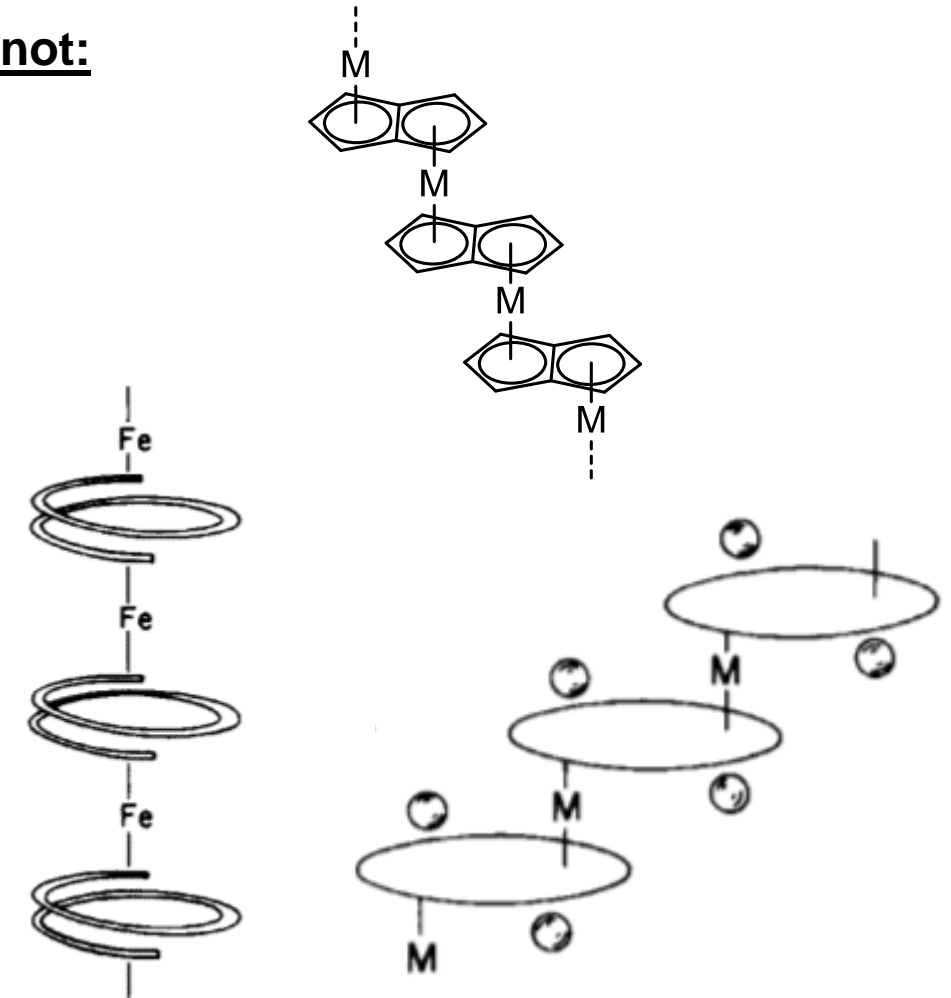
Sudhakar, A.; Katz, T. J. *J. Am. Chem. Soc.* **1986**, *108*, 179.



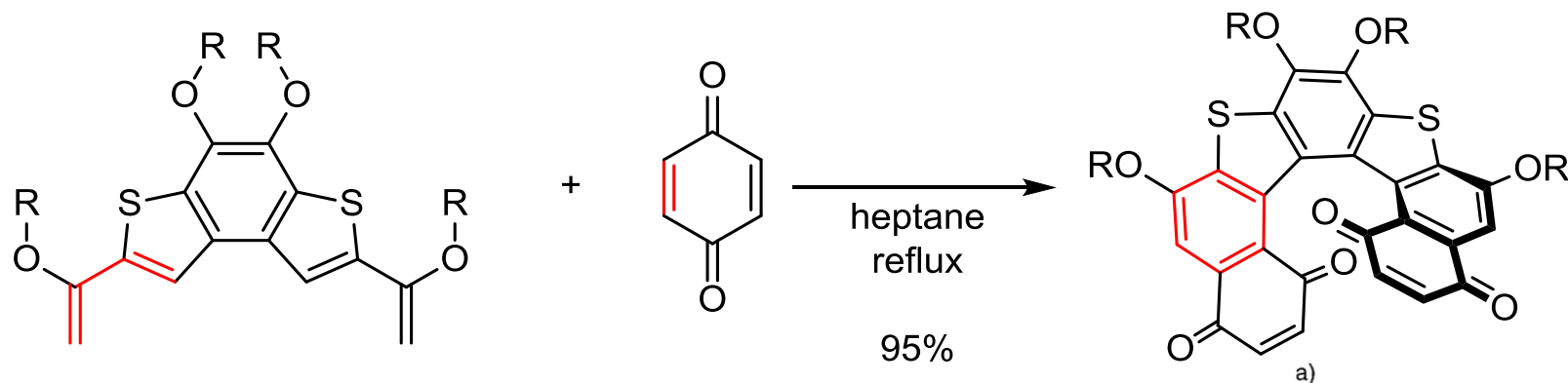
“It is obtained in excellent enantiomeric purity.”

- If** cp rings are “on top of each other (e.g. 7-ring helicene) an insertion of metal-center would give a mononuclear complex

- If not:**

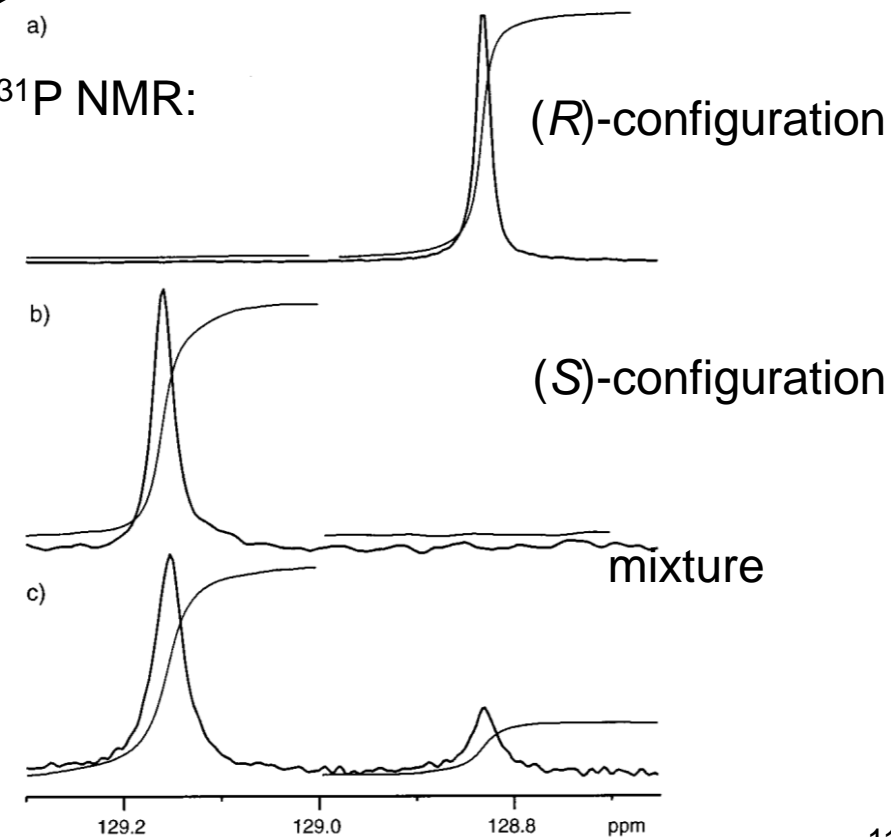


- Synthesis of helicenes bearing functional groups and heteroatoms

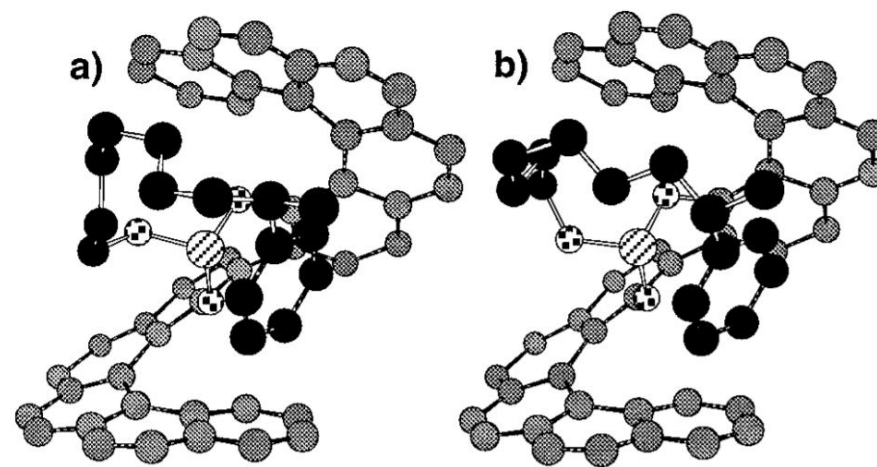
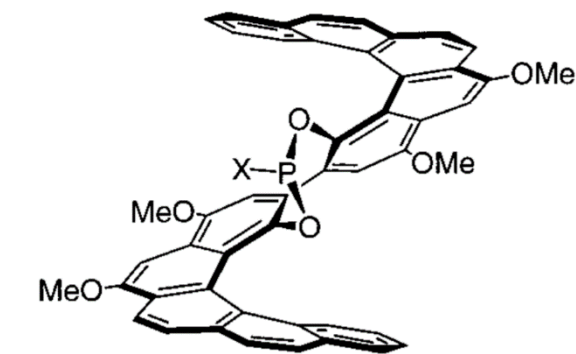


Phillips, K. E. S.; Katz, T. J.;
Jockusch, S.; Lovinger, A. J.; Turro,
N. J. *J. Am. Chem. Soc.* **2001**, *123*,
11899.

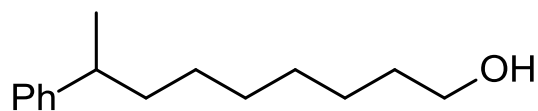
^{31}P NMR:



- Application of functionalized helicenes:

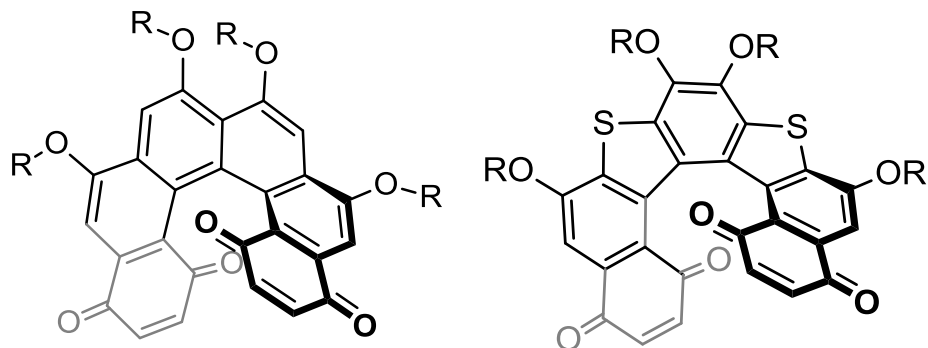


a) (R)-configuration, b) (S)-configuration

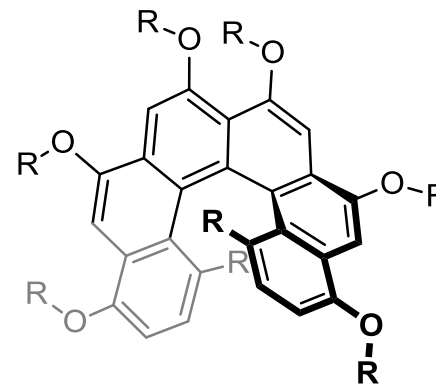


Weix, D. J.; Dreher, S. D.; Katz, T. J. *J. Am. Chem. Soc.* **2000**, *122*, 10027.

- Aggregation into columns:

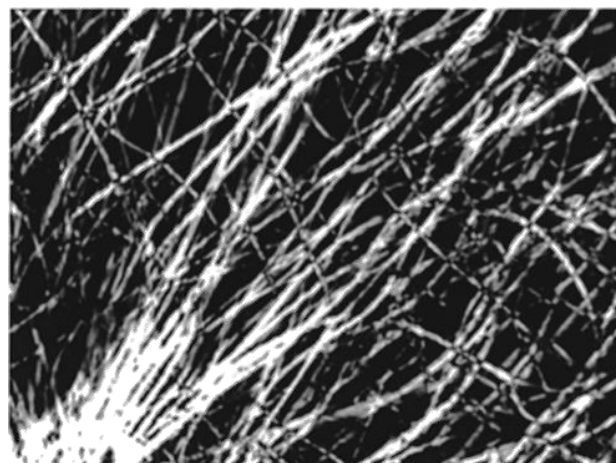
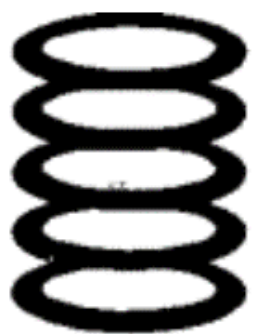


- Does not aggregate:

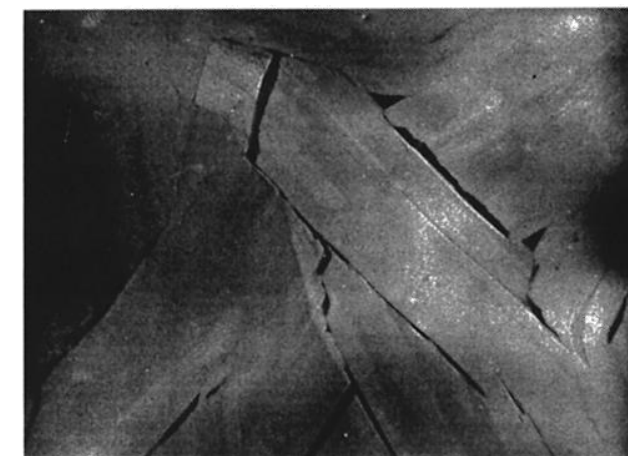


Phillips, K. E. S.; Katz, T. J.; Jockusch, J.; Lovinger, A. J.; Turro, N. J. *J. Am. Chem. Soc.* **2001**, *123*, 11899.

Nuckolls, C.; Katz, T. J.; Castellanos, L. *J. Am. Chem. Soc.* **1996**, *118*, 3767.



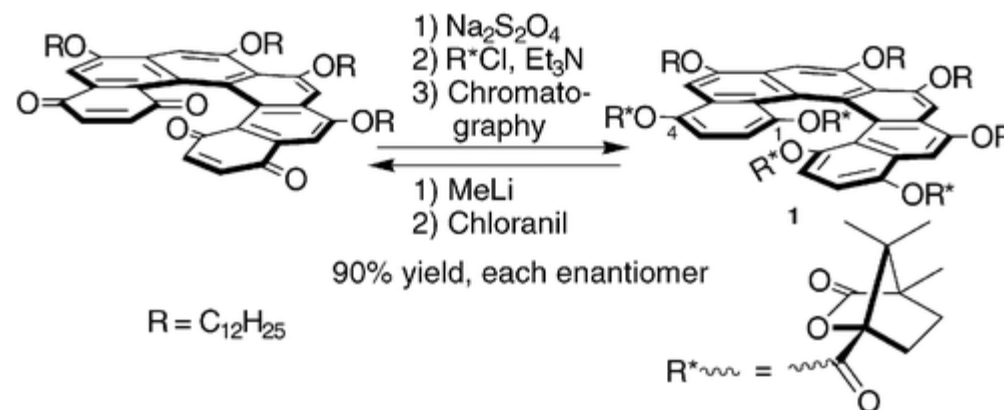
polarized light microscopy



TEM

- Chiral resolution of helicenes:

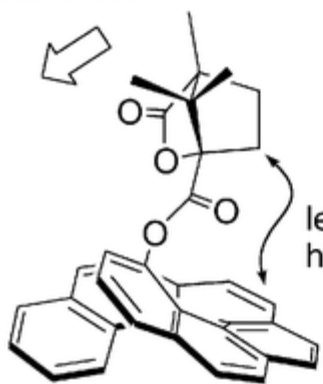
- Preparation of helicene camphanate



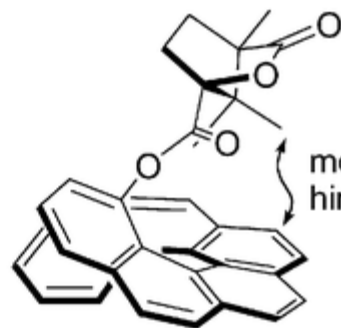
the lactone carbonyl points toward the helicene ring system
 $\rightarrow R_f$ is lower when the helicene has the *P*-configuration.

Thongpanchang, T.; Paruch, K.; Katz, T. J.; Rheingold, A. L.; Lam, K.-C.; Liable-Sands, L. *J. Org. Chem.* **2000**, *65*, 1850.

lactone down

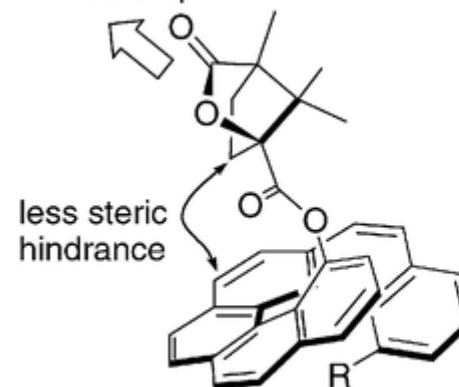


favored, $c \sim 180^\circ$



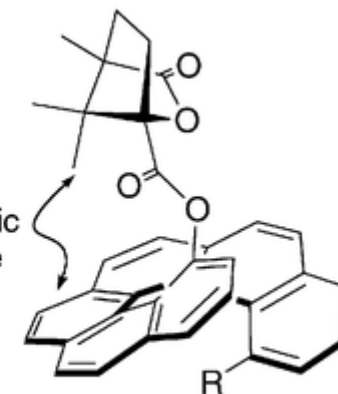
disfavored, $c \sim 0^\circ$

lactone up

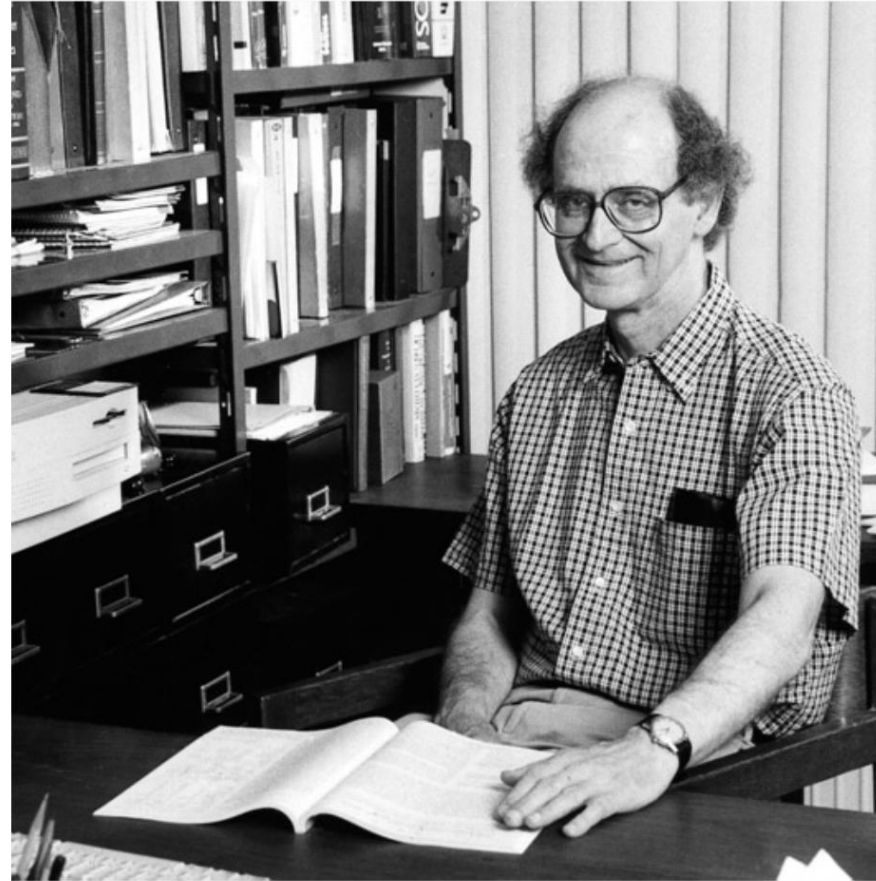


favored, $c \sim 0^\circ$

more steric hindrance



disfavored, $c \sim 180^\circ$



Thank you for your attention. 😊