α-Ketenyl Radical Intermediates in the Synthesis of Propellanes. A Formal Synthesis of Modhephene

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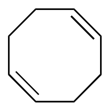
Tet. Lett. **1988,** *39*, 6975 – 6978.

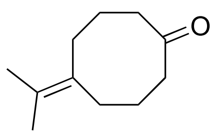


1-4

1) BH_3•THF, *then* NaOH, H_2O_2
2) TBSCl (1 eq), imidazole, CH_2Cl_2
3) TPAP cat., NMO, CH_2Cl_2
4) $TiCl_3$•$AlCl_3$, Li, *then* add product from reaction 3) and acetone, Δ

Step 4: Name Reaction? Mechanism?

see below



A

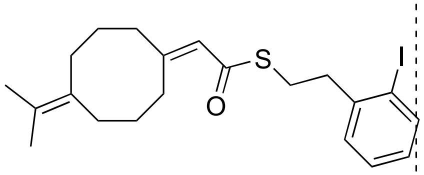
7-12

7) 40% HF, H_2O-CH_3CN
8) Swern
9) $Me_3SiCH_2CO_2Et$, LDA
10) 1M NaOH
11) 2-(*o*-iodophenyl)CH_2CH_2SH, DCC, DMAP, CH_2Cl
12) Bu_3SnH, AIBN, benzene, Δ

Step 9: Discuss the mechanism of the reaction, advanages and disadvantages compared to other methods. ***see below***

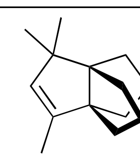
Step 12: Mechanism?

see below



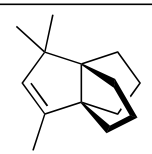
B

see next page



(±)-Modhephene

13-20



(±)-Modhephene

13) NaH, MeOCHO
14) TsN_3, Et_2NH
15) $CuSO_4$, toluene, Δ
16) *t*-BuLi, CO_2, *then* CH_2N_2
17) Me_2CuLi
18) MeI, KO*t*-Bu, *then* LiI, collidine
19) $LiAlH_4$
20) Martin's Sulfurane

Step 15: Hint: a new ring is formed in this step

Step 17: Mechanism? Rationalize and explain the synthetic utility of this type of strategy and discuss how it could be extended other types of reactions.

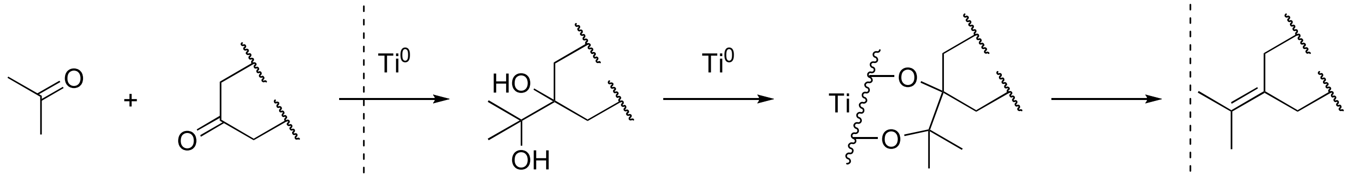
see below

Step 20: Structure of Martin's Sulfurane? What are other reagents that you could use for this transformations?

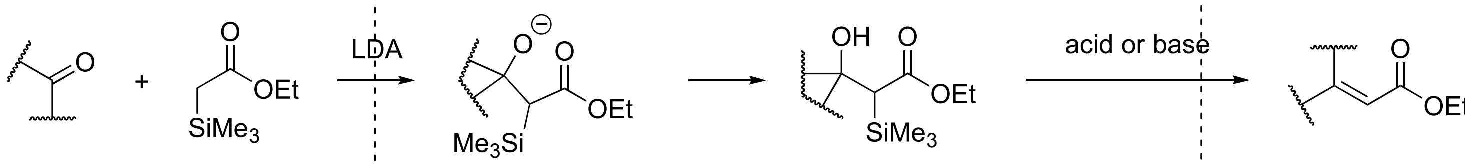
see below

Step 4: McMurry coupling **https://pubs.acs.org/doi/pdf/10.1021/jo00411a002**

Active titanium metal generated by reduction of TiCl3 by alkaline metal; reaction occurs on the surface of the active titanium particle



Step 9: Peterson Olefination **http://pubs.rsc.org/en/content/articlehtml/2002/cs/a908402i**

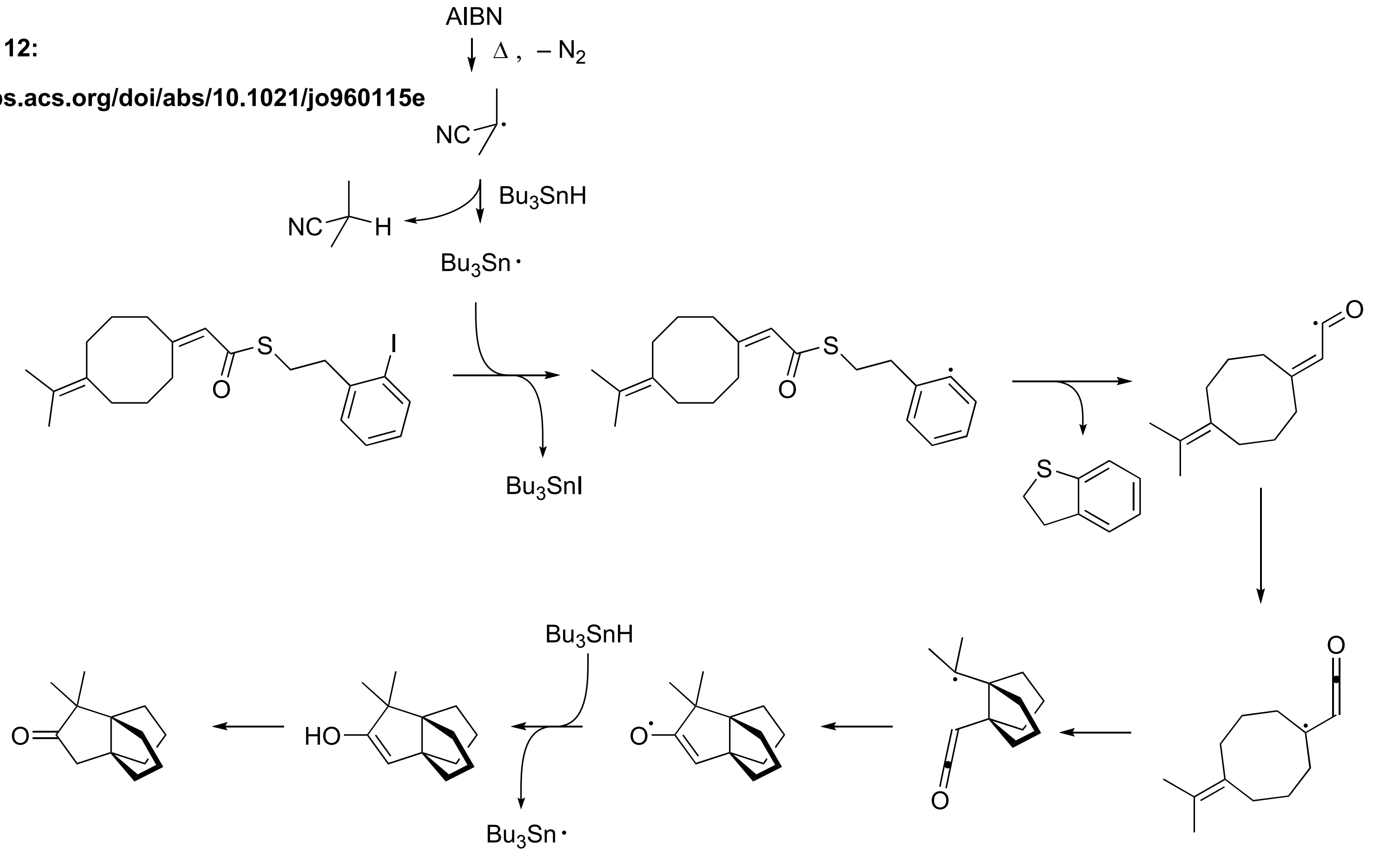


isolable intermediate

base gives Z- isomer predominantly
acid conditions favor E-isomer; byproducts easier to remove than in standard Wittig reaction

Step 12:

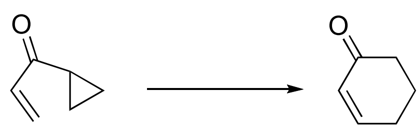
https://pubs.acs.org/doi/abs/10.1021/jo960115e



Step 17: alpha-keto cyclopropane ring-opening by cuprate; formally, a 1,5-addition that would require polarity reversal.

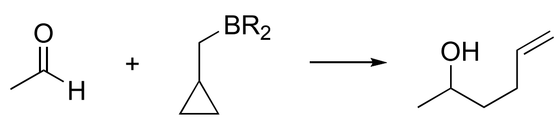
cyclopropane as enabling group due to ring strain (28 kcal/mol) that substantialy wakens the C-C bond, also due to torsinal strain (ca. 9 kcal/mol)

homo-Nazarov reaction



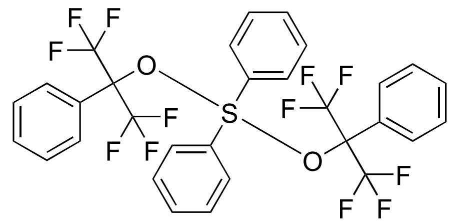
https://pubs.acs.org/doi/abs/10.1021/ol802970g

homo-allylboration reaction



https://pubs.acs.org/doi/abs/10.1021/ja2048682

Step 20: **Martin's sulfurane**



Burgess reagent