狄爾斯－阿德耳環化加成反應

The Diels-Alder Cycloaddition Reaction

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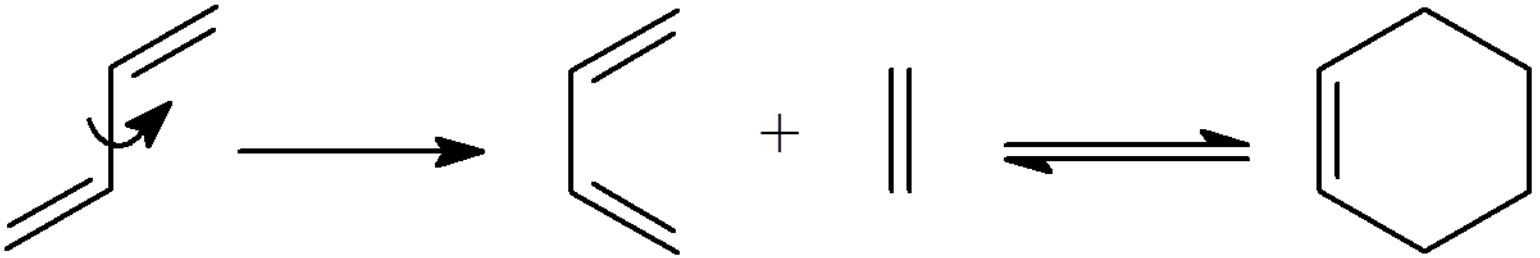
Introduction

Otto Diels and Kurt Alder got the Nobel Prize in 1950 for their discovery on the reaction.

It is great usefulness because of high yield and high stereospecificity.

原　理

The 1.4-cycloaddition reaction of a conjugated δ-cis-diene to an alkene (dienophile) in which 2 new δ bonds are formed from 2 π bonds.



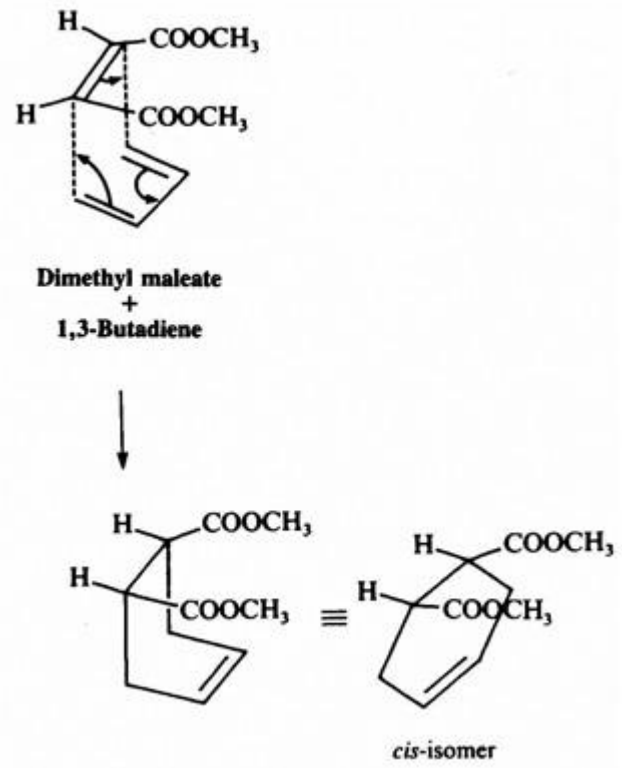
δ-trans

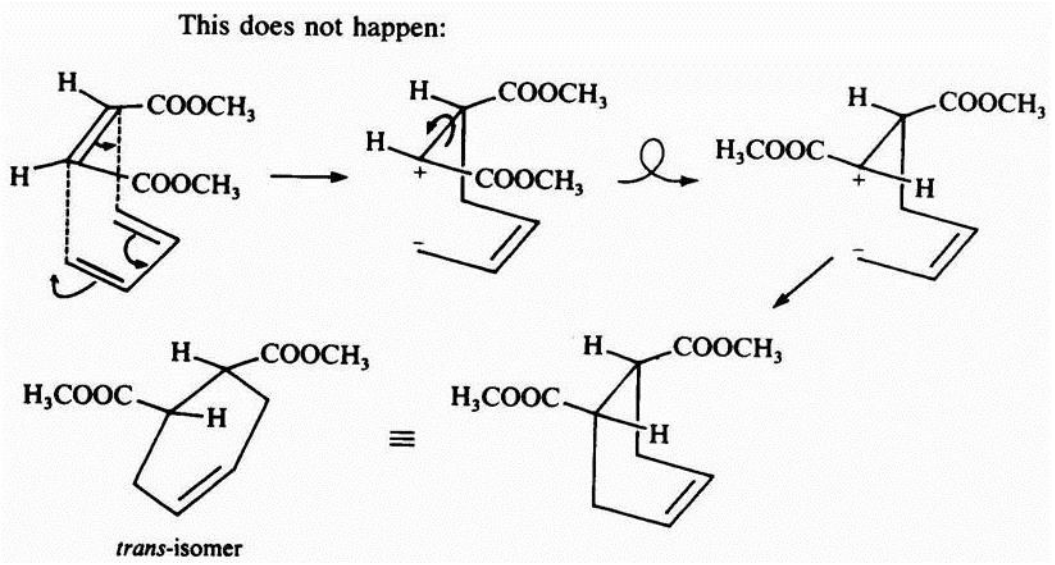
δ-cis

diene **dienophile** **adduct**

原　理

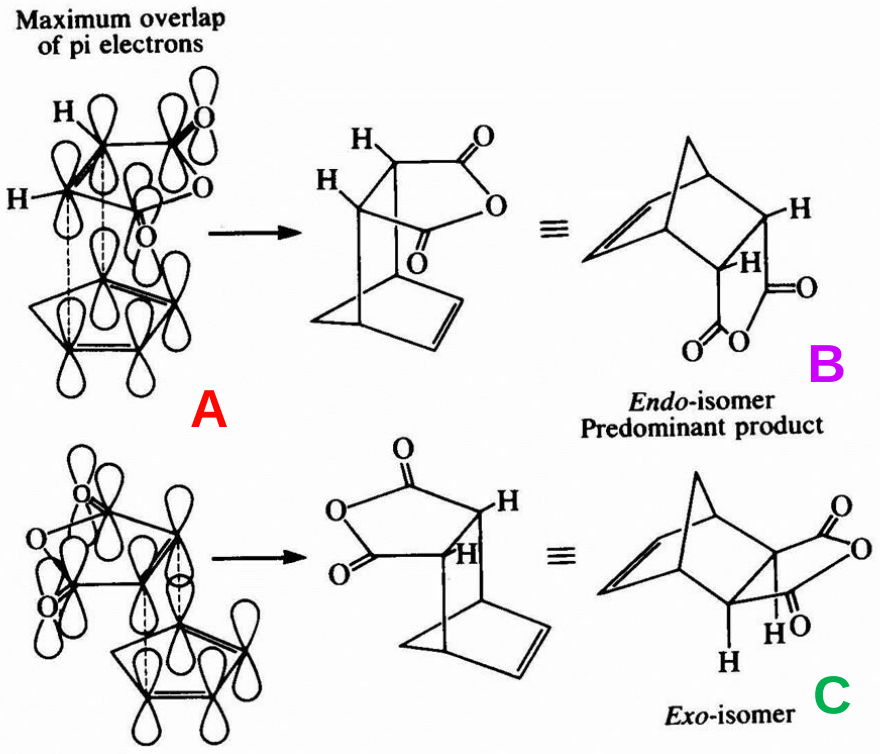
High stereospecificity: Both new δ bonds are formed almost simultaneously.

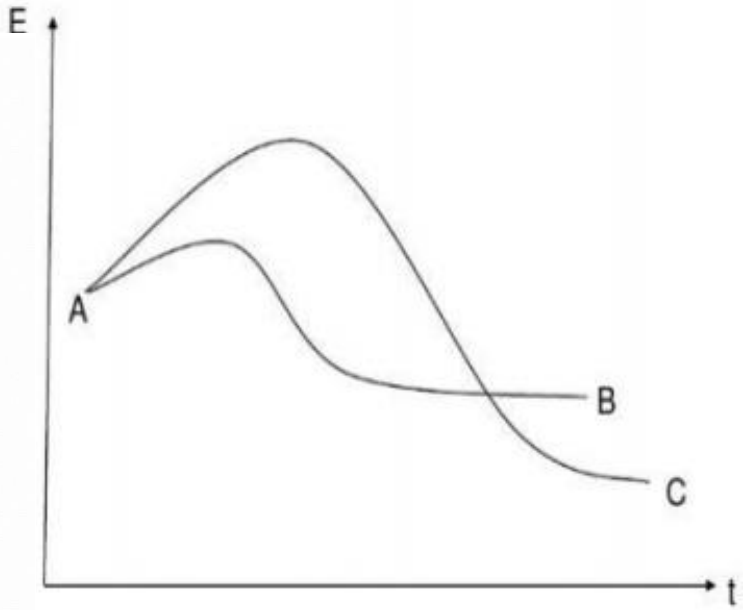




原　理

The endo-isomer is the major product.

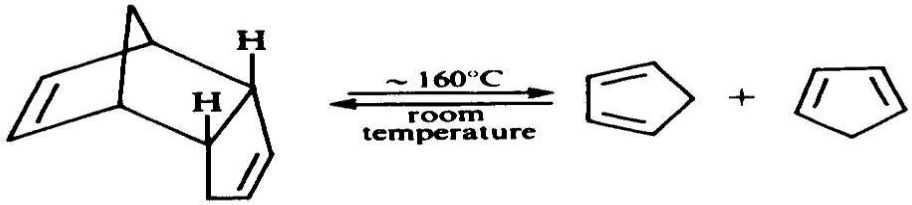




B: kinetic control product
(動力控制產物)
C: thermodynamic control product
(熱力控制產物)

合 成 步 驟

Cracking of dicyclopentadiene:



Dicyclopentadiene
den 0.98
MW 132.20

Cyclopentadiene
bp 41°C, den 0.80
MW 66.10

5mL dicyclopentadiene in 50mL R.B. flask

↓

fractional distillation (stirring bar)

↓

collect the monomeric cyclopentadiene (b.p.=40~42℃) into an ice-cooled receiver

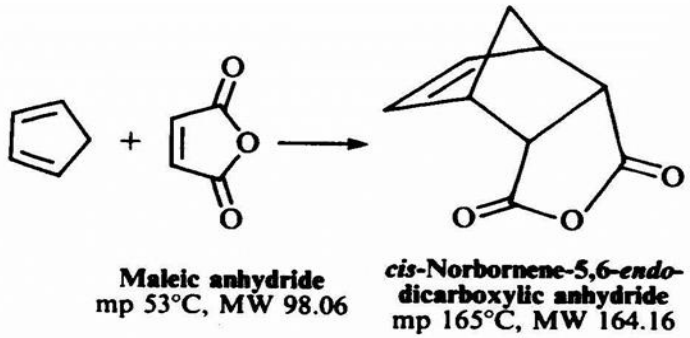
↓

keep the Cp's temp. near 0℃

合 成 步 驟

Diels-Alder Reaction

Synthesis of cis-Norbornene-5,6-endo-dicarboxylic Anhydride



Maleic anhydride
mp 53°C, MW 98.06

cis-Norbornene-5,6-*endo*-dicarboxylic anhydride
mp 165°C, MW 164.16

0.5 g of maleic anhydride + 2.0 mL of E.A. in 50 mL flask

↓

heat on a hot plate

↓

add 2.0 mL of n-hexane

↓

cool the solution thoroughly in an ice-water bath (some anhydride may crystallize)

合 成 步 驟

add 0.5 mL of dry cyclopentadiene (ice-water bath)

↓

swirl for a few minutes (ice-water bath)

↓ (adduct separates as a white solid)

heat the mixture (hot plate) until the solid is dissolved

↓

stand for the crystal formation

↓

collect the crystal (m.p. 164~165℃)

↓

weight

↓

calculate the % yield

Check out

1. 繳交產物並告知產物淨重。
2. 將產物結晶圖片上傳 Zuvio
3. 實驗問題：1, 2

The End !

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