Fukuyama Group - Group Meeting Problems
06/05/2012

1

\[
\begin{align*}
&\text{MeO\text{-}O} &\text{MeO\text{-}O} &\text{MeO} \\
&\text{MeO\text{-}O} &\text{MeO\text{-}O} &\text{Me}
\end{align*}
\]

\[
\text{O}_3, \text{CH}_2\text{Cl}_2, -78 \degree \text{C}; \quad \text{hv} \\
\text{Me}_2\text{S}, -78 \degree \text{C} \text{to rt} \quad \text{C}_6\text{D}_6, 30 \degree \text{C}
\]

52\% (2 steps)


2

\[\text{MeO\text{-}OH} + \text{Ph\text{-}N\text{=N\text{-}CO\text{-}Me}}\]

\[
\text{Rh}_2\text{(S-DOSP)}_4 (1 \text{ mol\%}) \quad \text{heptane, rt to reflux;} \\
\text{Sc(OTf)}_3 (20 \text{ mol\%}) \quad \text{reflux}
\]

95\%, 82\% ee


3

\[
\text{TBSO} \quad \text{CO}_2\text{Et} \\
\text{N} \quad \text{O} \quad \text{OBz} \\
\text{Bn} \quad \text{N} \quad \text{OBz}
\]

\[
\text{MeCN, rt;} \\
\text{BnMe}_3\text{NCN} \quad \text{MeCN} \\
\text{1) NaOEt} \quad \text{EtOH, rt} \\
\text{86\%} \\
\text{2) NaH, DMF} \quad 0 \degree \text{C}, 70\%
\]

66\%


4

\[
\text{NH}_2 \\
\text{Me\text{-}CO}_2\text{H}
\]

\[
\text{Ac}_2\text{O (2.2 eq.)} \\
\text{Et}_3\text{N}, \text{DMAP} \\
\text{malononitrile} \\
\text{NaOH} \\
\text{AcOH, 50 \degree \text{C};} \\
\text{evap;} \\
\text{H}_2\text{O, rt}
\]

83\%

1. Reaction schematic:

\[
\begin{align*}
\text{CO}_2\text{Bn} & \quad \stackrel{\text{NCS}}{\text{1,4-dimethylpiperazine}} \quad \text{CH}_2\text{Cl}_2, 0 \degree \text{C;} \\
\phantom{\text{CO}_2\text{Bn}} & \quad \text{Cl}_3\text{CCO}_2\text{H} \quad \text{THF}, 0 \degree \text{C}; \\
\phantom{\text{CO}_2\text{Bn}} & \quad \text{HO} \quad \text{TIPS} \quad 59\%
\end{align*}
\]

\[
\begin{align*}
\text{Me} & \quad \text{O} \quad \text{Me} \\
\text{O} & \quad \text{LDA} \quad \text{(2.6 eq)} \\
\phantom{\text{Me}} & \quad \text{THF, 0 \degree \ C;} \\
\phantom{\text{O}} & \quad \text{H}_2\text{O} \quad \text{(5 mol\%)} \\
\phantom{\text{LDA}} & \quad \text{C}_6\text{H}_5\text{Cl}, 40 \degree \text{C} \\
\phantom{\text{Me}} & \quad \text{95\%, 92\% ee}
\end{align*}
\]


2. Reaction schematic:

\[
\begin{align*}
\text{CO}_2\text{Me} & \quad \text{+} \quad \text{CO}_2\text{Me} \\
\text{NHBOc} & \quad \text{KOT-Bu} \quad \text{THF, rt} \\
\phantom{\text{CO}_2\text{Me}} & \quad \text{acetone, 40 \degree \ C} \\
\phantom{\text{NHBOc}} & \quad \text{THF, 100 \degree \ C} \\
\text{Br} & \quad \text{CO} \quad \text{Ph} \\
\text{O} & \quad \text{K}_2\text{CO}_3 \\
\phantom{\text{Br}} & \quad \text{MeNH}_2 \\
\text{MeN} & \quad \text{Boc} \\
\text{CO}_2\text{Me} & \quad \text{CO}_2\text{Me}
\end{align*}
\]


3. Reaction schematic:

\[
\begin{align*}
\text{O} & \quad \text{O} \quad \text{LDA} \quad \text{(2.6 eq)} \\
\phantom{\text{O}} & \quad \text{THF, 0 \degree \ C;} \\
\phantom{\text{O}} & \quad \text{PBu}_3 \\
\text{Ph} & \quad \text{N}_3 \\
\phantom{\text{O}} & \quad \text{THF, 45 \degree \ C} \\
\phantom{\text{PBu}_3} & \quad \text{45 \degree \ C} \\
\text{57\%} & \quad \text{64\%}
\end{align*}
\]


4. Reaction schematic:

\[
\begin{align*}
\text{t-BuO} & \quad \text{O} \quad \text{TBS} \\
\phantom{\text{t-BuO}} & \quad \text{CH}_2\text{Cl}_2\text{-TFA-H}_2\text{O} \quad \text{rt} \\
\phantom{\text{O}} & \quad \text{CH}_2\text{Cl}_2\text{-Et}_2\text{O} \quad \text{reflux} \\
\phantom{\text{TBS}} & \quad \text{CH}_2\text{Cl}_2\text{-Et}_2\text{O} \quad \text{reflux} \\
\text{Ph} & \quad \text{MeMgBr} \\
\phantom{\text{t-BuO}} & \quad \text{Et}_3\text{N, Bu}_4\text{NI} \\
\phantom{\text{O}} & \quad \text{TMSOTf, rt;} \\
\phantom{\text{TBS}} & \quad \text{1 M HCl aq.} \\
\text{50\% (2 steps)} & \quad \text{55\%}
\end{align*}
\]

Fukuyama Group - Group Meeting Problems

06/20/2012

1. **Nitro Group Transformation**

- Reaction: \( \text{NO}_2 \) → \( \text{CO}_2 \) Et → \( \text{CO}_2 \) Et
- Conditions: THF, \(-70^\circ\text{C}\); sat. \( \text{NH}_4\text{Cl} \) aq
- Yield: 65% (E:Z = 98:2)


2. **Rhodium-Catalyzed Annulation**

- Reaction: \( \text{Rh}_{2}(\text{pfb})_4 \) (cat.) → \( \text{CO}_2 \) Et → \( \text{CO}_2 \) Et
- Conditions: benzene, rt; 94%
- Conditions: xylene, 145 °C; 68%


3. **Thiophene Formation**

- Reaction: \( \text{SO}_2 \) Ph → \( \text{SO}_2 \) Ph
- Conditions: THF, \(-78^\circ\text{C}\);


4. **Aza-Annulation**

- Reaction: \( \text{CHO}_2 \) → \( \text{N}=\text{CH} \) → \( \text{NH} \)
- Conditions: KOH, rt; 97%
- Conditions: CH\(_2\)Cl\(_2\); rt; 73%


5. **Diastereomeric Mixture Formation**

- Reaction: \( \text{SO}_2 \) Ph → \( \text{CO}_2 \) Et
- Conditions: toluene, reflux; 95%
- Conditions: \( n\text{-Bu}_3\text{SnH} \) (5.0 eq); AIBN (2.0 eq)