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Lithium Diisopropylamide-mediated Enolizations:
Solvent-Independent Rates -- Solvent-Dependent Mechanisms

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## Supporting Information

I. Plots of $k_{obsd}$ versus [THF] in toluene cosolvent for the enolization of cyclohexanecarboxylic acid *tert*-butyl ester (**1**, 0.004 M) by LDA (0.10 M)

II. Plot of $k_{obsd}$ versus [LDA] for the enolization of cyclohexanecarboxylic acid *tert*-butyl ester (**1**, 0.004 M) in neat THF

III. Plot of $k_{obsd}$ versus [HMPA] for the enolization of cyclohexanecarboxylic acid *tert*-butyl ester-$d_1$ (**1-$d_1$**, 0.004 M) by LDA (0.10 M) in various THF concentrations

IV. Plots of $k_{obsd}$ versus [LDA] in THF (9.4 M) and hexane cosolvent for the enolization of cyclohexanecarboxylic acid *tert*-butyl ester-$d_1$ (**1-$d_1$**, ≤0.004 M) with HMPA

V. Plot of $k_{obsd}$ versus [DMPU] in THF (8.2 M) and hexane cosolvent for the enolization of cyclohexanecarboxylic acid *tert*-butyl ester (**1**, 0.004 M) by LDA (0.10 M)

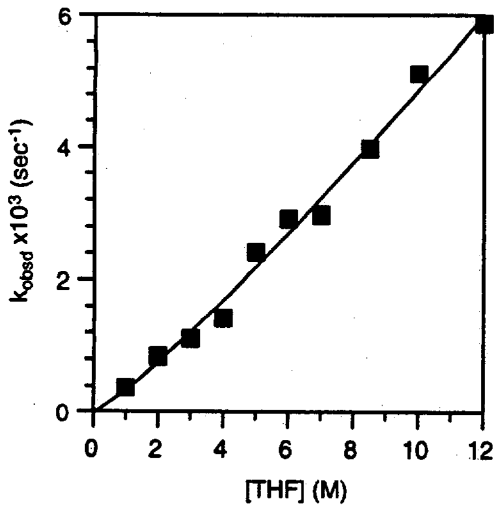
VI. Plots of $k_{obsd}$ versus [LDA] in THF (8.2 M) and hexane cosolvent for the enolization of cyclohexanecarboxylic acid *tert*-butyl ester (**1**, ≤0.004 M) with DMPU

VII. Plots of $k_{obsd}$ versus [THF] in hexane cosolvent for the enolization of cyclohexanecarboxylic acid *tert*-butyl ester (**1**, 0.004 M) with DMPU

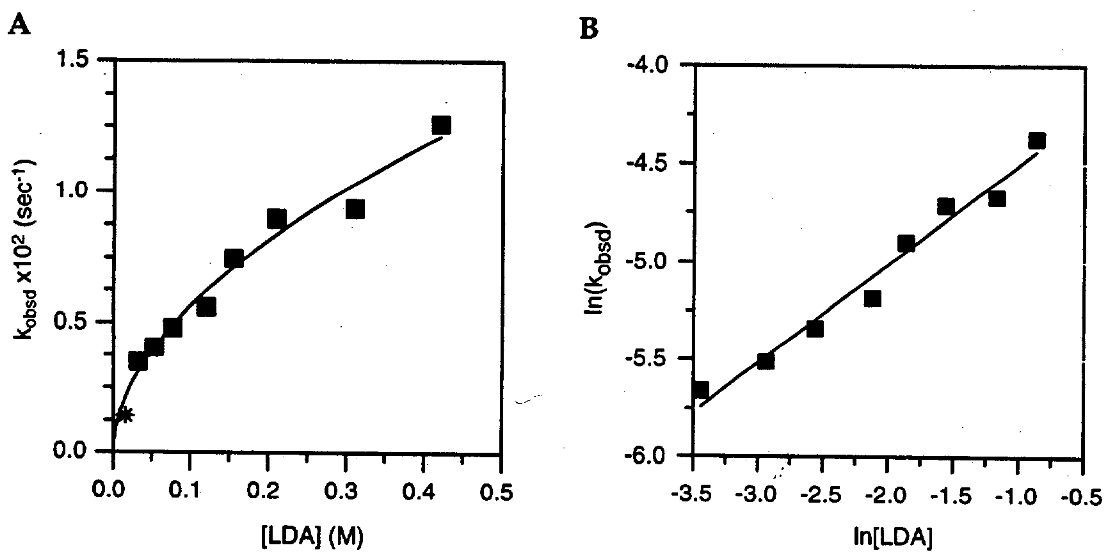
VIII. Plot of $k_{obsd}$ versus [*t*-BuOMe] in hexane cosolvent for the enolization of cyclohexylpyrrolidin-1-yl-methanone (**6**, 0.0025 M) by LDA (0.050 M)

IX. Plot of $k_{obsd}$ versus [LDA] for the enolization of cyclohexyl-pyrrolidin-1-yl-methanone (**6**, 0.003 M) in neat *t*-BuOMe

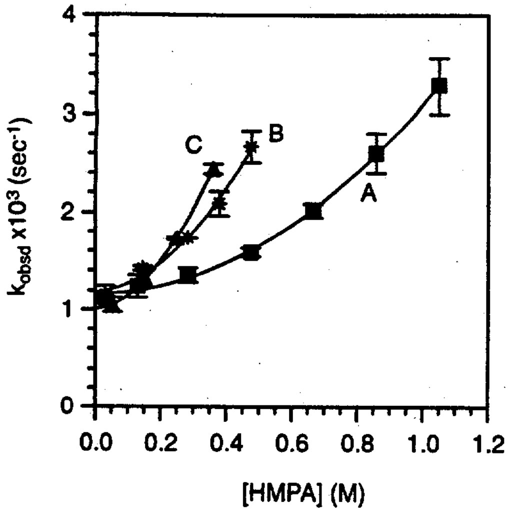
X. Tables of data for plots in Sections I-IX



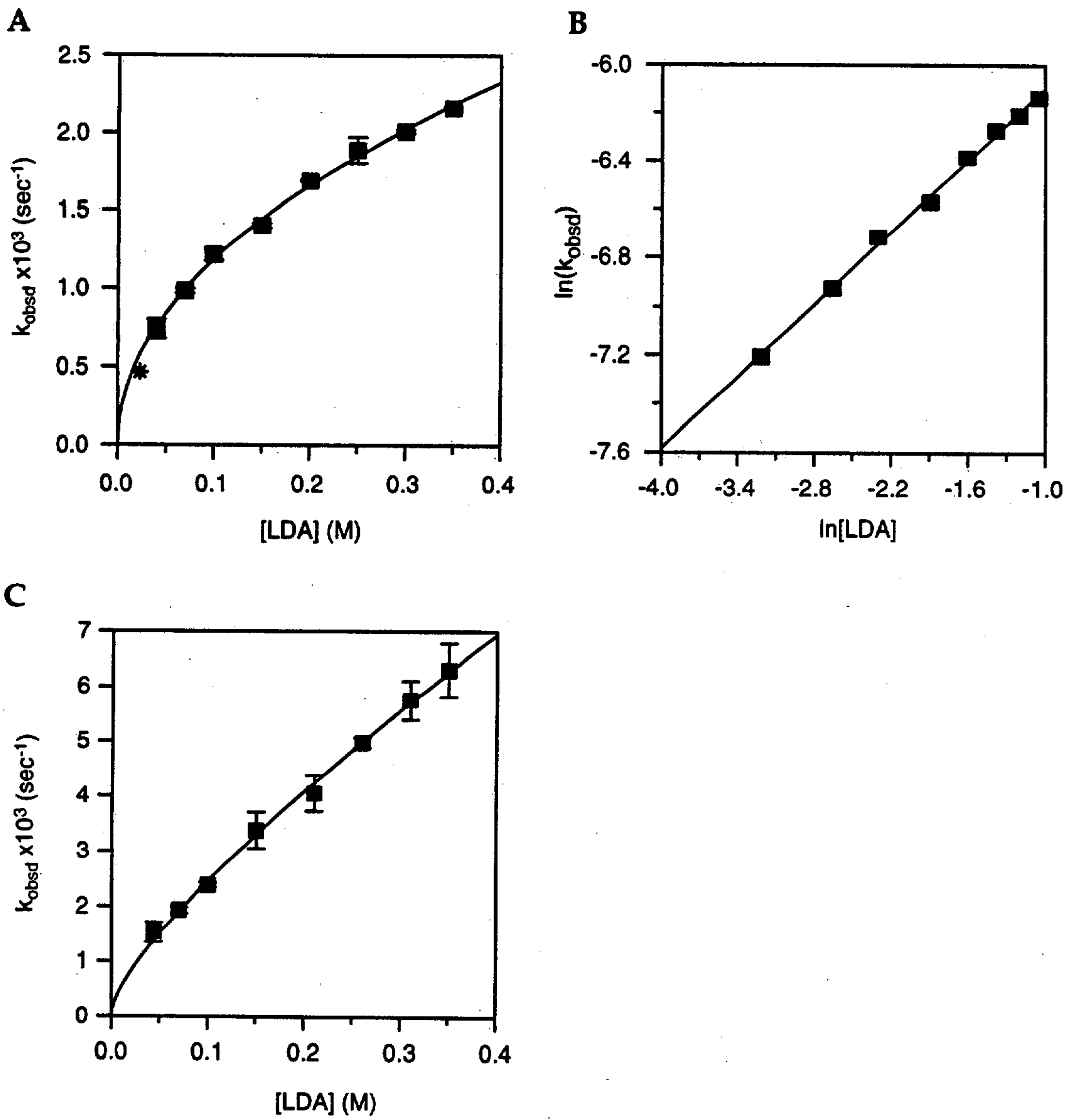

**I.** Plot of $k_{obsd}$ versus [THF] in toluene cosolvent for the enolization of cyclohexanecarboxylic acid *tert*-butyl ester (**1**, 0.004 M) by LDA (0.10 M) at -53 ± 0.5 °C. The curve depicts the result of an unweighted least-squares fit to $k_{obsd} = k[THF]^n + k'$ (Table 1).




**II.** **(A)** Plot of $k_{obsd}$ versus [LDA] for the enolization of cyclohexanecarboxylic acid *tert*-butyl ester (**1**, 0.004 M) by LDA in neat THF at -53 ± 0.5 °C. The curve depicts the result of an unweighted least-squares fit to $k_{obsd} = k[LDA]^n$ (Table 1). The asterisk (*) was not included in the fit. **(B)** log-log variant of plot in (A).




**III.** Plots of $k_{obsd}$ versus [HMPA] in hexane cosolvent for the enolization of cyclohexanecarboxylic acid *tert*-butyl ester-$d_1$ (**1**-$d_1$, 0.004 M) by LDA (0.10 M) at -35 ± 0.5 °C with: **A** THF (9.4 M) in hexane cosolvent; **B** THF(2.0 M) in hexane cosolvent; **C** THF (0.20 M) in cyclopentane cosolvent. The curves depict the results of unweighted least-squares fits to $k_{obsd} = k[HMPA]^n + k'$. The values of n are 1.97 ± 0.09, 1.88 ± 0.30 , and 1.82 ± 0.08 for curves A, B, and C (respectively, Table 1).




**IV.** Plots of $k_{obsd}$ versus [LDA] in THF (9.4 M) and hexane cosolvent for the enolization of cyclohexanecarboxylic acid *tert*-butyl ester-$d_1$ (**1**-$d_1$, ≤0.004 M) by LDA at -35 ± 0.5 °C with: **(A)** HMPA (0.10 M). The curve depicts the result of an unweighted least-squares fit to $k_{obsd} = k[LDA]^n$; **(B)** Log-log variant of plot in (A); **(C)** HMPA (0.80 M). The curve depicts the result of an unweighted least-squares fit to $k_{obsd} = k[LDA]^{0.5} + k'[LDA]^n$ (Table 1). The asterisk (*) was not included in the fit.

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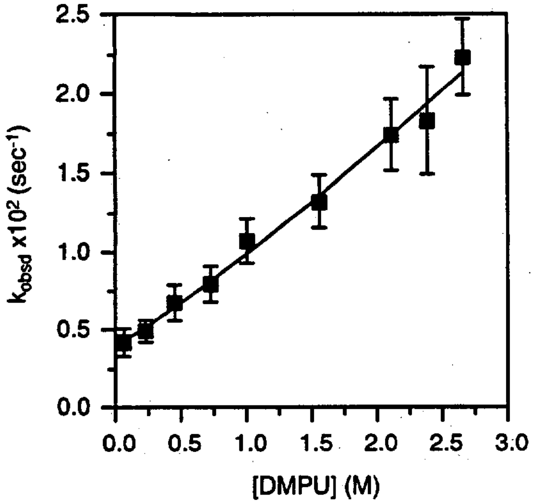
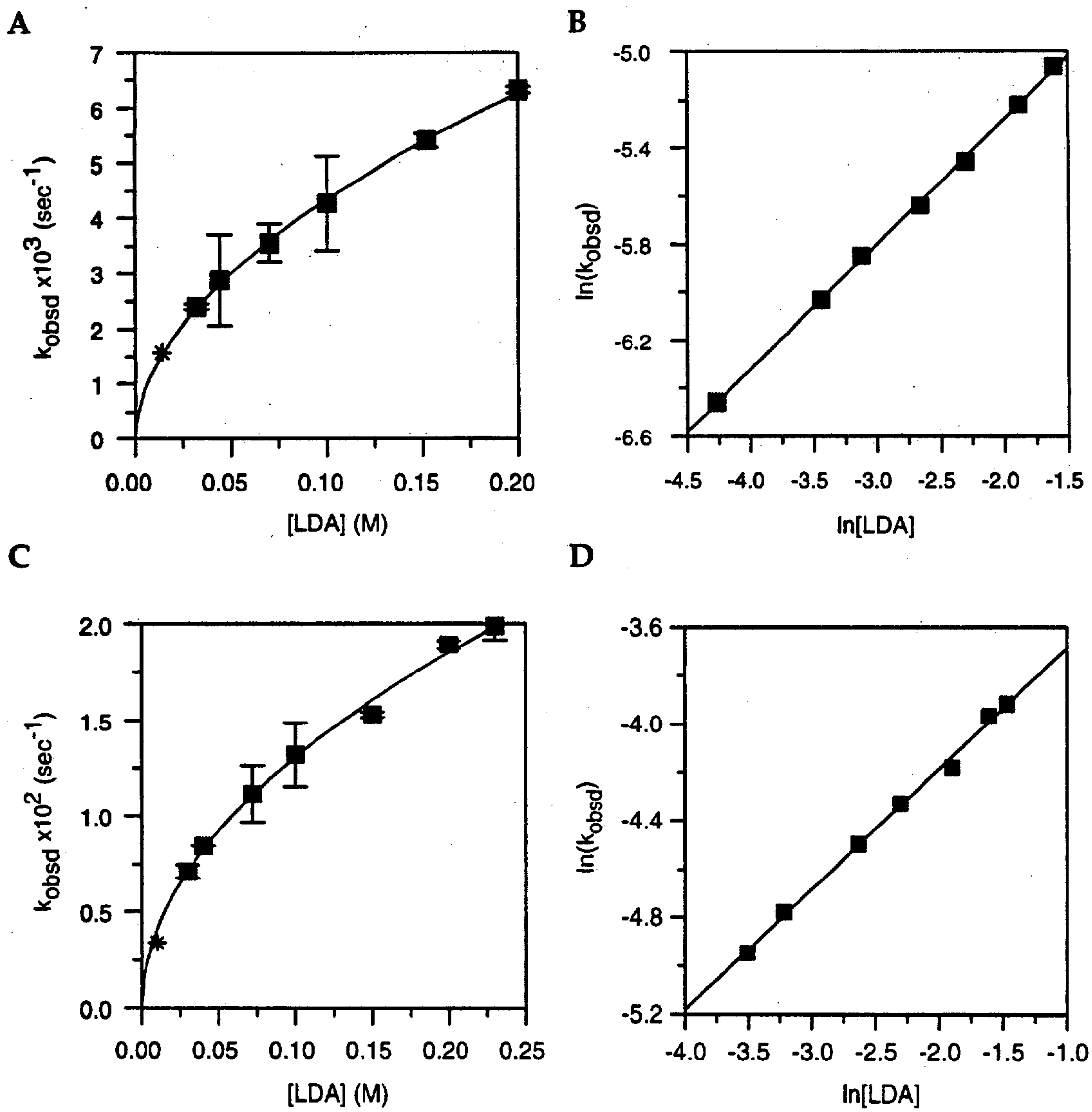
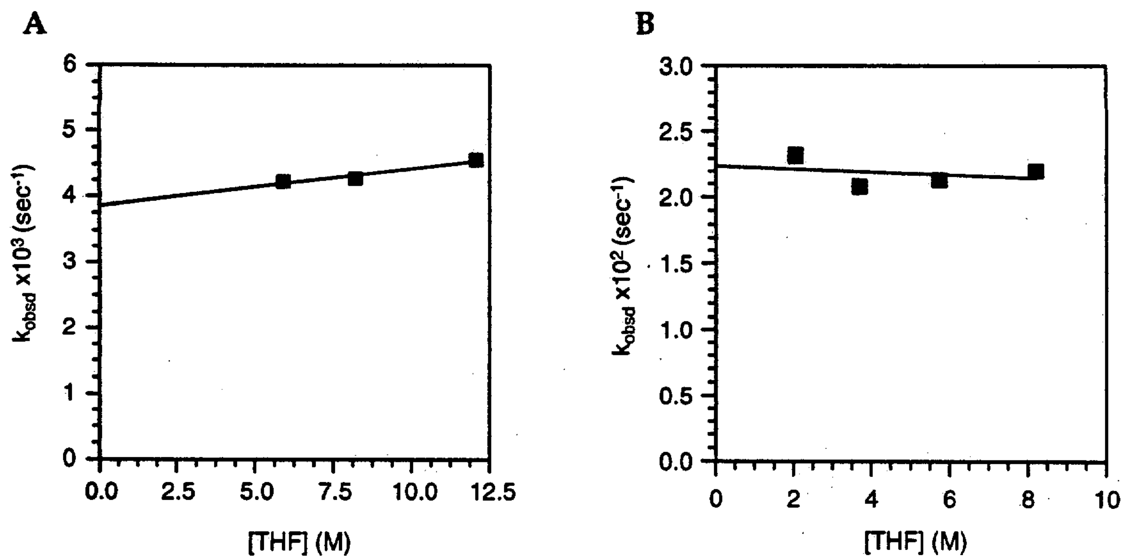


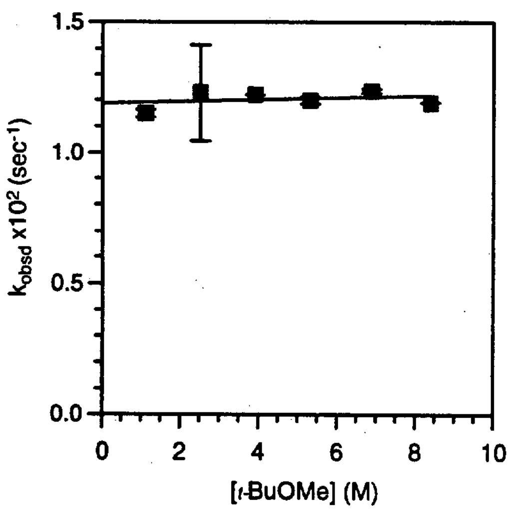

**V.** Plot of $k_{obsd}$ versus [DMPU] in THF (8.2 M) and hexane cosolvent for the enolization of cyclohexanecarboxylic acid *tert*-butyl ester (**1**, 0.004 M) by LDA (0.10 M) at -53 $\pm$ 0.5 °C. The curve depicts the result of an unweighted least-squares fit to $k_{obsd} = k[DMPU]^n + k'$ (Table 1).



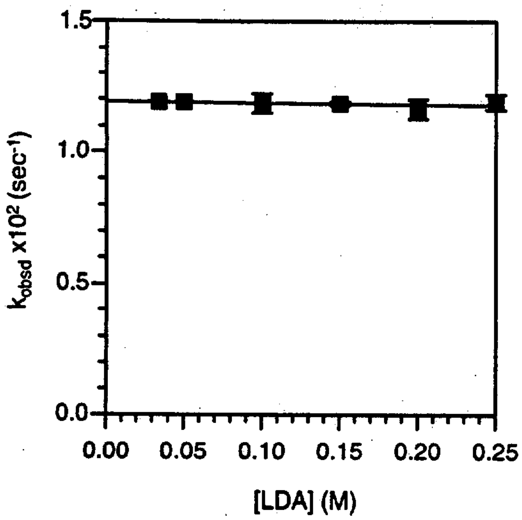

**VI.** Plots of $k_{obsd}$ versus [LDA] in THF (8.2 M) and hexane cosolvent for the enolization of cyclohexanecarboxylic acid *tert*-butyl ester (**1**, $\leq$0.004 M) at -53 $\pm$ 0.5 °C with: **(A)** DMPU (0.066 M); **(B)** Log-log variant of (A); **(C)** DMPU (1.56 M). The curves depict the results of unweighted least-squares fits to $k_{obsd} = k[LDA]^n$ (Table 1); **(D)** Log-log variant of (B). The asterisks (*) were not included in the fits.




**VII.** Plots of $k_{obsd}$ versus [THF] in hexane cosolvent for the enolization of cyclohexanecarboxylic acid *tert*-butyl ester (**1**, 0.004 M) by LDA (0.10 M) at -53 ± 0.5 °C with: **(A)** DMPU (0.066 M); **(B)** DMPU (1.56 M). The curves depict the results of unweighted least-squares fits to $k_{obsd} = k[THF] + k'$. Poor solubility of a putative LDA/DMPU complex precluded measurements below 5.0 M THF in plot **(A)**.




**VIII.** Plot of $k_{obsd}$ versus [*t*-BuOMe] in hexane cosolvent for the enolization of cyclohexylpyrrolidin-1-yl-methanone (**5**, 0.0025 M) by LDA (0.050 M) at 0 °C. The curve depicts the result of an unweighted least-squares fit to $k_{obsd} = k[t\text{-BuOMe}] + k'$ (Table 1).




**IX.** Plot of $k_{obsd}$ versus [LDA] for the enolization of cyclohexyl-pyrrolidin-1-yl-methanone (**6**, 0.003 M) by LDA in neat *t*-BuOMe at 0 °C. The curve depicts the result of an unweighted least-squares fit to $k_{obsd}$ = k[LDA] + k′ (Table 1).

X. Tables of data for plots in Sections I.

Data for Figure I

| [THF] (M) | $k_{obsd}1$ ($sec^{-1}$) |
|---|---|
| 1.00 | 0.000370 ± 1E-5 |
| 2.00 | 0.000845 ± 1E-5 |
| 3.00 | 0.00111 ± 3E-5 |
| 4.00 | 0.00142 ± 2E-5 |
| 5.00 | 0.00241 ± 5E-5 |
| 6.00 | 0.00292 ± 8E-5 |
| 7.00 | 0.00298 ± 1E-4 |
| 8.50 | 0.00397 ± 8E-5 |
| 10.0 | 0.00512 ± 1E-4 |
| 12.0 | 0.00587 ± 2E-4 |

Data for figure II

| [LDA] (M) | $k_{obsd}1$ ($sec^{-1}$) |
|---|---|
| 0.016 | 0.00143 ± 8E-5 |
| 0.032 | 0.00348 ± 3E-4 |
| 0.053 | 0.00403 ± 1E-4 |
| 0.077 | 0.00480 ± 1E-4 |
| 0.120 | 0.00560 ± 3E-4 |
| 0.155 | 0.00746 ± 3E-4 |
| 0.210 | 0.00897 ± 5E-4 |
| 0.310 | 0.00936 ± 4E-4 |
| 0.420 | 0.0126 ± 9E-4 |

Data for figure IIIA

| [HMPA] (M) | $k_{obsd}1$ ($sec^{-1}$) | $k_{obsd}2$ ($sec^{-1}$) | $k_{obsd}$(avg) ($sec^{-1}$) |
|---|---|---|---|
| 0.030 | 0.00113 ± 5E-5 | 0.00110 ± 4E-5 | 0.00112 ± 2E-5 |
| 0.130 | 0.00132 ± 2E-5 | 0.00116 ± 4E-5 | 0.00124 ± 1E-4 |
| 0.283 | 0.00141 ± 2E-5 | 0.00130 ± 1E-4 | 0.00136 ± 7E-5 |
| 0.475 | 0.00162 ± 5E-5 | 0.00156 ± 1E-5 | 0.00159 ± 4E-5 |
| 0.666 | 0.00207 ± 8E-5 | 0.00197 ± 1E-4 | 0.00202 ± 7E-5 |
| 0.858 | 0.00246 ± 5E-5 | 0.00275 ± 1E-4 | 0.00261 ± 2E-4 |
| 1.05 | 0.00349 ± 9E-5 | 0.00309 ± 1E-4 | 0.00329 ± 3E-4 |

Data for Figure IIIB

| [HMPA] (M) | $k_{obsd}1$ ($sec^{-1}$) | $k_{obsd}2$ ($sec^{-1}$) | $k_{obsd}(avg)$ ($sec^{-1}$) |
|---|---|---|---|
| 0.030 | 0.00122 ± 3E-5 | 0.00109 ± 5E-5 | 0.00116 ± 9E-5 |
| 0.145 | 0.00144 ± 4E-5 | 0.00140 ± 3E-5 | 0.00142 ± 2E-5 |
| 0.283 | 0.00174 ± 7E-5 | 0.00173 ± 4E-5 | 0.00174 ± 0E-5 |
| 0.379 | 0.00217 ± 5E-5 | 0.00201 ± 6E-5 | 0.00209 ± 1E-4 |
| 0.475 | 0.00256 ± 8E-5 | 0.00279 ± 1E-4 | 0.00268 ± 2E-4 |

Data for Figure IIIC

| [HMPA] (M) | $k_{obsd}1$ ($sec^{-1}$) | $k_{obsd}2$ ($sec^{-1}$) | $k_{obsd}(avg)$ ($sec^{-1}$) |
|---|---|---|---|
| 0.053 | 0.000992 ± 3E-5 | 0.00110 ± 1E-5 | 0.00105 ± 8E-5 |
| 0.153 | 0.00126 ± 4E-5 | 0.00138 ± 2E-5 | 0.00132 ± 9E-5 |
| 0.249 | 0.00173 ± 5E-5 | 0.00172 ± 3E-5 | 0.00173 ± 1E-5 |
| 0.360 | 0.00247 ± 1E-5 | 0.00240 ± 5E-5 | 0.00244 ± 5E-5 |

Data for Figure IVA

| [LDA] (M) | $k_{obsd}1$ ($sec^{-1}$) | $k_{obsd}2$ ($sec^{-1}$) | $k_{obsd}(avg)$ ($sec^{-1}$) |
|---|---|---|---|
| 0.023 | 0.000468 ± 2E-5 | | |
| 0.040 | 0.000786 ± 2E-5 | 0.000697 ± 2E-5 | 0.000741 ± 6E-5 |
| 0.070 | 0.000972 ± 3E-5 | 0.000993 ± 3E-5 | 0.000983 ± 1E-5 |
| 0.100 | 0.00119 ± 3E-5 | 0.00124 ± 3E-5 | 0.00122 ± 4E-5 |
| 0.150 | 0.00139 ± 5E-5 | 0.00141 ± 4E-5 | 0.00140 ± 2E-5 |
| 0.200 | 0.00169 ± 6E-5 | 0.00169 ± 8E-5 | 0.00169 ± 1E-1 |
| 0.250 | 0.00183 ± 4E-5 | 0.00195 ± 9E-5 | 0.00189 ± 8E-5 |
| 0.300 | 0.00202 ± 7E-5 | 0.00200 ± 9E-5 | 0.00200 ± 1E-5 |
| 0.350 | 0.00215 ± 6E-5 | 0.00216 ± 7E-5 | 0.00216 ± 1E-5 |

Data for Figure IVB

| [LDA] (M) | $k_{obsd}1$ ($sec^{-1}$) | $k_{obsd}2$ ($sec^{-1}$) | $k_{obsd}(avg)$ ($sec^{-1}$) |
|---|---|---|---|
| 0.040 | 0.00165 ± 2E-5 | 0.00140 ± 4E-5 | 0.00152 ± 1E-4 |
| 0.070 | 0.00190 ± 3E-5 | 0.00198 ± 5E-5 | 0.00194 ± 5E-5 |
| 0.100 | 0.00241 ± 4E-5 | 0.00235 ± 5E-5 | 0.00238 ± 4E-5 |
| 0.150 | 0.00315 ± 8E-5 | 0.00361 ± 1E-4 | 0.00333 ± 3E-4 |
| 0.210 | 0.00429 ± 8E-5 | 0.00382 ± 7E-5 | 0.00405 ± 3E-4 |
| 0.260 | 0.00504 ± 1E-4 | 0.00491 ± 1E-4 | 0.00498 ± 9E-5 |
| 0.310 | 0.00601 ± 1E-4 | 0.00550 ± 2E-4 | 0.00576 ± 3E-4 |
| 0.350 | 0.00665 ± 2E-4 | 0.00596 ± 1E-4 | 0.00630 ± 5E-4 |

Data for Figure V

| [DMPU] (M) | $k_{obsd}1$ ($sec^{-1}$) | $k_{obsd}2$ ($sec^{-1}$) | $k_{obsd}3$ ($sec^{-1}$) | $k_{obsd}(avg)$ ($sec^{-1}$) |
|---|---|---|---|---|
| 0.0657 | 0.00480 ± 5E-5 | 0.00360 ± 1E-4 | | 0.00420 ± 8E-4 |
| 0.231 | 0.00539 ± 8E-5 | 0.00443 ± 7E-5 | | 0.00491 ± 7E-4 |
| 0.452 | 0.00757 ± 9E-5 | 0.00591 ± 1E-4 | | 0.00674 ± 1E-3 |
| 0.729 | 0.00712 ± 1E-4 | 0.00875 ± 2E-4 | | 0.00794 ± 1E-3 |
| 1.00 | 0.0117 ± 3E-4 | 0.00969 ± 2E-4 | | 0.0107 ± 1E-3 |
| 1.56 | 0.0114 ± 3E-4 | 0.0134 ± 3E-4 | 0.0147 ± 4E-5 | 0.0132 ± 2E-3 |
| 2.11 | 0.0183 ± 7E-4 | 0.0148 ± 6E-4 | 0.0190 ± 4E-5 | 0.0174 ± 2E-3 |
| 2.39 | 0.0159 ± 1E-3 | 0.0207 ± 6E-4 | | 0.0183 ± 3E-3 |
| 2.66 | 0.0240 ± 1E-3 | 0.0206 ± 1E-3 | | 0.0223 ± 2E-3 |

Data for Figure VIA

| [LDA] (M) | $k_{obsd}1$ ($sec^{-1}$) | $k_{obsd}2$ ($sec^{-1}$) | $k_{obsd}(avg)$ ($sec^{-1}$) |
|---|---|---|---|
| 0.014 | 0.00157 ± 3E-5 | | |
| 0.032 | 0.00236 ± 7E-5 | 0.00243 ± 7E-5 | 0.00240 ± 5E-5 |
| 0.044 | 0.00230 ± 2E-5 | 0.00346 ± 9E-5 | 0.00288 ± 8E-4 |
| 0.070 | 0.00379 ± 4E-5 | 0.00329 ± 4E-5 | 0.00354 ± 3E-4 |
| 0.100 | 0.00480 ± 5E-5 | 0.00360 ± 2E-4 | 0.00420 ± 8E-4 |
| 0.152 | 0.00532 ± 8E-5 | 0.00550 ± 7E-5 | 0.00541 ± 1E-4 |
| 0.200 | 0.00629 ± 7E-5 | 0.00637 ± 1E-4 | 0.00633 ± 6E-5 |

Data for Figure VIB

| [LDA] (M) | $k_{obsd}1$ ($sec^{-1}$) | $k_{obsd}2$ ($sec^{-1}$) | $k_{obsd}3$ ($sec^{-1}$) | $k_{obsd}(avg)$ ($sec^{-1}$) |
|---|---|---|---|---|
| 0.010 | 0.00342 ± 8E-5 | | | |
| 0.030 | 0.00687 ± 1E-4 | 0.00736 ± 1E-4 | | 0.00712 ± 4E-4 |
| 0.040 | 0.00852 ± 4E-4 | 0.00830 ± 1E-4 | | 0.00841 ± 2E-4 |
| 0.072 | 0.0101 ± 2E-4 | 0.0122 ± 2E-4 | | 0.0112 ± 1E-4 |
| 0.100 | 0.0114 ± 3E-4 | 0.0134 ± 3E-4 | 0.00147 ± 4E-4 | 0.0132 ± 2E-3 |
| 0.150 | 0.0154 ± 5E-4 | 0.0152 ± 3E-4 | | 0.0153 ± 1E-4 |
| 0.200 | 0.0188 ± 5E-4 | 0.0191 ± 6E-4 | | 0.0190 ± 2E-4 |
| 0.230 | 0.0194 ± 5E-4 | 0.0204 ± 5E-4 | | 0.0199 ± 7E-4 |

Data for Figure VIIA

| [THF] (M) | $k_{obsd}$ ($sec^{-1}$) |
|---|---|
| 5.90 | 0.00422 ± 4E-5 |
| 8.21 | 0.00420 ± 5E-4 |
| 12.1 | 0.00456 ± 6E-5 |

Data for Figure VIIB

| [THF] (M) | $k_{obsd}$ ($sec^{-1}$) |
|---|---|
| 2.05 | 0.0232 ± 1E-3 |
| 3.69 | 0.0208 ± 9E-4 |
| 5.75 | 0.0213 ± 1E-3 |
| 8.21 | 0.0220 ± 2E-3 |

Data for Figure VIII

| [*t*-BuOMe] (M) | $k_{obsd}1$ ($sec^{-1}$) | $k_{obsd}2$ ($sec^{-1}$) | $k_{obsd}$(avg) ($sec^{-1}$) |
|---|---|---|---|
| 1.12 | 0.0116 ± 3E-4 | 0.0114 ± 4E-4 | 0.0115 ± 1E-4 |
| 2.52 | 0.0110 ± 4E-4 | 0.0136 ± 4E-4 | 0.0123 ± 2E-3 |
| 3.92 | 0.0122 ± 5E-4 | 0.0122 ± 4E-4 | 0.0122 ± 0E-4 |
| 5.32 | 0.0121 ± 2E-4 | 0.0119 ± 2E-4 | 0.0120 ± 1E-4 |
| 6.88 | 0.0124 ± 3E-4 | 0.0123 ± 4E-4 | 0.0124 ± 1E-4 |
| 8.40 | 0.0119 ± 3E-4 | 0.0119 ± 3E-4 | 0.0119 ± 0E-4 |

Data for Figure IX

| [LDA] (M) | $k_{obsd}1$ ($sec^{-1}$) | $k_{obsd}2$ ($sec^{-1}$) | $k_{obsd}$(avg) ($sec^{-1}$) |
|---|---|---|---|
| 0.034 | 0.0199 ± 2E-4 | 0.0119 ± 9E-4 | 0.0119 ± 0E-4 |
| 0.050 | 0.0119 ± 3E-4 | 0.0119 ± 3E-4 | 0.0119 ± 0E-4 |
| 0.100 | 0.0121 ± 5E-4 | 0.0116 ± 4E-4 | 0.0119 ± 3E-4 |
| 0.150 | 0.0118 ± 3E-4 | 0.0119 ± 2E-4 | 0.0119 ± 1E-4 |
| 0.200 | 0.0119 ± 1E-4 | 0.0114 ± 3E-4 | 0.0117 ± 4E-4 |
| 0.250 | 0.0117 ± 1E-4 | 0.0121 ± 3E-4 | 0.0119 ± 3E-4 |