

Reaction of Lithium Dialkylcuprates with β -Alkoxy and β -Alkylthio $\alpha\beta$ -Unsaturated Carbonyl Compounds

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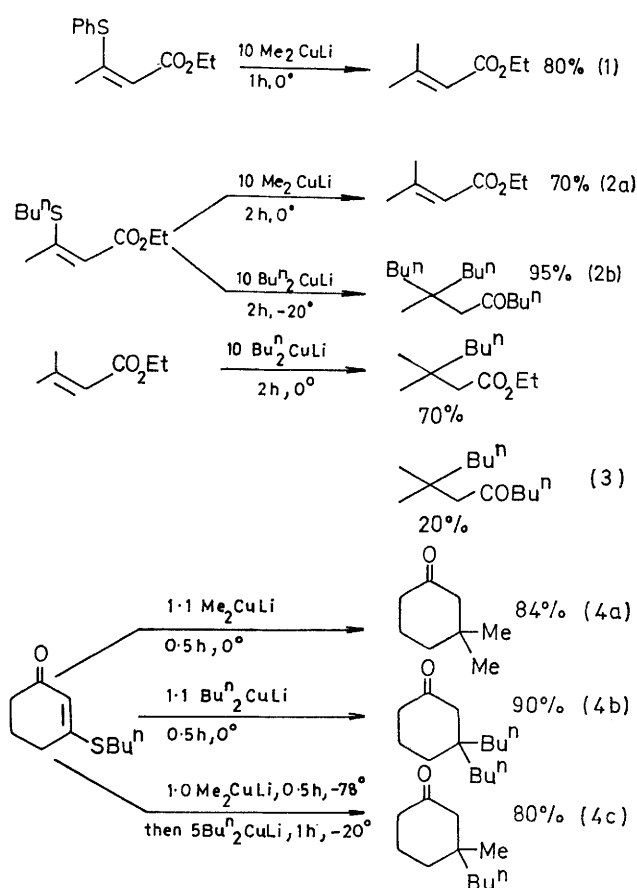
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Summary β -Alkoxy- and β -alkylthio- $\alpha\beta$ -ethylenic esters and ketones are converted in high yield into β -alkyl- $\alpha\beta$ -ethylenic esters and into $\beta\beta$ -dialkyl ketones using lithium dialkylcuprate reagents.

A RECENT report¹ and the current general interest in reactions of organometallic reagents with β -amino-,² β -alkoxy-,³ β -thioalkoxy-,⁴ and β -chloro- $\alpha\beta$ -unsaturated carbonyl compounds prompts us to report our results in this area. We have treated a variety of β -heteroatom substituted $\alpha\beta$ -ethylenic esters and ketones with lithium dialkylcuprate reagents in diethyl ether under inert atmosphere. In all cases, the β -hetero substituent is replaced by an alkyl group from the dialkylcuprate reagent; whereas the β -alkyl enoate esters formed in these reactions generally do not react further with lithium dimethylcuprate, the β -alkyl enone intermediates undergo a conjugate addition reaction⁶ to produce $\beta\beta$ -disubstituted ketones. The results are summarized in equations (1)–(4).

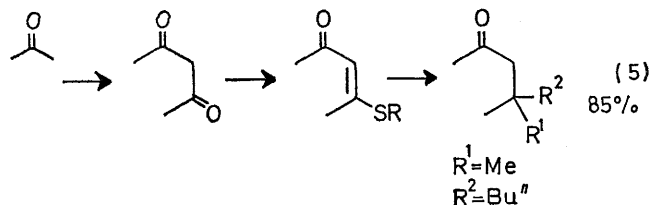
Although replacement of a β -phenylthio-group [equation (1)] or a β -butylthio-group [equation (2a)] in an $\alpha\beta$ -ethylenic ester is achieved effectively using lithium dimethylcuprate, the more reactive lithium di-*n*-butylcuprate converts the initially formed $\beta\beta$ -dialkylacrylate ester into the corresponding β -*n*-butyl ketone [equations (2b) and (3)]; this reaction most likely proceeds first by conversion of the enoate ester into the corresponding ethylenic ketone⁷ and then by conjugate addition of an *n*-butylcopper reagent.[†] Thus despite the broad utility of alkylcopper reagents in conjugate addition reactions,⁶ these reagents are not generally useful for converting $\beta\beta$ -dialkylacrylate esters into $\beta\beta\beta$ -trialkylacetates.

β -Acetoxy- $\alpha\beta$ -ethylenic ketones are converted into β -methyl enones using 1.0 equiv. of lithium dimethyl-



[†] Organocopper reagents undergo conjugate addition to enones more easily than to enoate esters: see ref. 6.

cuprate at -78° and into $\beta\beta$ -dimethyl ketones using 2.7 equiv. of this reagent.¹ In contrast, we find that 3-ethoxycyclohex-2-enone reacts with a large excess of lithium di-*n*-



butylcuprate at 0° to form mainly 3-*n*-butylcyclohex-2-enone and little 3,3-di-*n*-butylcyclohexanone. In further contrast, β -*n*-butylthiocyclohexenone reacts with only 1.1

equiv. of lithium dialkylcuprate reagent at 0° to produce the corresponding $\beta\beta$ -diadduct and no β -alkyl enone [equations (4a) and (4b)]. The sensitivity of these reactions to temperature is indicated by equation (4c), in which two different alkyl groups have been attached to the carbon atom β to the carbonyl group.

The overall transformation outlined in equation (5) thus allows replacement of one carbonyl oxygen atom in symmetrical 1,3-diketones by two different alkyl groups,⁸ and it allows α -tertiary alkylation of ketones.⁹

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