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The CuBr/Fe Promoted Olefin Alkylation by 2-Br-2-Cl-Carboxylate Methyl Esters.

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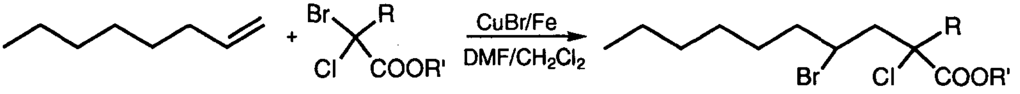
***Abstract*:** Methyl 2-Br-2-Cl-carboxylates react with 1-octene in DMF/CH_2Cl_2 in a radical process promoted by CuBr/Fe, yielding 2-alkyl-2-Cl-4-Br-carboxylates smoothly and efficiently.

Addition of halogenated compounds to alkenes, through the homolytic cleavage of a carbon-halogen bond, is a well investigated procedure to synthesize C-C bonds.[1] While much attention has been paid to reactions of trihaloacetate esters,[1,2] the use of dihalogenated esters has been essentially restricted to some dichloroacetates[3] or α,α-dichloro olefinic esters[4]; these reactions are assisted by transition metal salts or their complexes[4] like CuCl,[3b] Cu(bpy)Cl[3a] or $RuCl_2(PPh_3)_3$,[3c-d,4] and require rather vigorous conditions, such as heating to 120-160°C for long times, very likely to activate the C-Cl bond cleavage.

Recently we developed an efficient route to methyl 2-Br-2-Cl-carboxylates.[5] These substrates give rise to radicals more quickly than the corresponding α,α-dichloro esters, likely owing to the very easy cleavage of the C-Br bond, also facilitated by the geminal chlorine;[6] on using CuBr/Fe in dimethylformamide (DMF), indeed, the radical reductive homocoupling of methyl 2-Br-2-Cl-carboxylates occurred efficiently under mild conditions.[7] Now we report the reaction of methyl 2-Br-2-Cl-carboxylates with 1-octene in the presence of CuBr/Fe (Scheme).



Scheme

The addition products were obtained in fair yields from a number of methyl 2-Br-2-Cl-esters at room temperature (Table). The main by-products (ca. 25 mol/mol %) were dimethyl α,α'-dichloro-succinates from the homocoupling reaction, which occurred exclusively starting from methyl 2-Br-2-Cl-phenylacetate or using more substituted olefins, such as cyclohexene. Methyl 2,2-dichloro esters were quite unreactive under the same reaction conditions.

Table. The Addition of Methyl 2-Br-2-Cl-Carboxylates to 1-Octene

item	R	R'	product yield (mol/mol %)[a]
1	n-C_4H_8-	-CH_3	60
2	i-C_3H_7-	-CH_3	58
3	C_6H_5-CH_2-	-CH_3	48
4	CH_3-	-CH_3	62
5	C_6H_5-	-CH_3	-
6	n-C_4H_8-	-CH_2-CH=CH_2	61

[a] based on the ester; all products are 1:1 mixtures of diastereoisomers

In a typical procedure, iron powder (5 mmol) and CuBr (5 mmol) were weighted in a Schlenk tube, and then 1:1 DMF/CH_2Cl_2 (5 ml), 1-octene (25 mmol) and methyl 2-Br-2-Cl-hexanoate (5mmol) were added under N_2 atmosphere. The mixture was stirred at room temperature, and after 48 h diluted with petroleum ether (40-60°C) (10 ml) and filtered to remove residual Cu^0 and Fe^0; then the filtrate was washed with 5% HCl (2 x 5 ml). The organic phase was dried over Na_2CO_3 and evaporated. The products were isolated by chromatography on silica using 1:9 diethyl ether/petroleum ether (40-60) as eluant. Structures were consistent with their MS and ^{1}H-NMR spectra, and gave satisfactory elemental analyses.[8]

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8. Mass spectra were obtained on a combined HP 5890 GC - HP 5989A MS Engine. ^{1}H-NMR spectra were recorded on a Bruker WP80 spectrometer. Reagents and solvents were standard grade commercial products and used without further purification. DMF and CH_2Cl_2 were dried over three batches of 3Å sieves (5% w/v, 12 h).

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