Tetrahedron Letters, Vol.31, No.41, pp 5925-5926, 1990
Printed in Great Britain

0040-4039/90 $3.00 + .00
Pergamon Press plc

A NOVEL SYNTHESIS OF PERFLUOROALKYLATED α,β-UNSATURATED CARBONYL COMPOUNDS

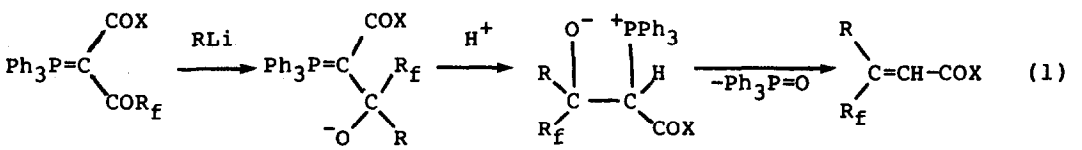
Yanchang Shen* and Tielin Wang
Shanghai Institute of Organic Chemistry, Academia Sinica
345 Lingling Lu, Shanghai 200032, China

Summary A novel intramolecular Wittig reaction via ylide-anion formation and protonation and its application to the synthesis of perfluoroalkylated α,β-unsaturated carbonyl compounds are described.

Synthesis of perfluoroalkylated α,β-unsaturated carbonyl compounds is attracting interest since such compounds can be applied to the synthesis of fluorine-containing analogues of natural products.[1]

Intramolecular Wittig reaction is a well known methodology for the synthesis of alkynes,[2] particularly fluoro species,[3] starting from carbonyl- or biscarbonylmethylenetriphenylphosphoranes. However, biscarbonylmethylenetriphenylphosphoranes are very stable because of the strong electron-withdrawing effect of the two carbonyl groups and unable to react with aldehydes or ketones. Therefore, how to use fluorinated biscarbonylmethylenetriphenylphosphoranes as a reagent in Wittig reaction to the synthesis of fluorinated alkenes is of interest. Recently, we reported a novel ylide-anion formation resulting from nucleophilic addition of n-butyllithium to the synthesis of α-trifluoromethyl-trans-allylic alcohols.[4] We now wish to report a novel synthesis of perfluoroalkylated α,β-unsaturated carbonyl compounds by intramolecular Wittig reaction via ylide-anion formation and protonation starting from fluorinated biscarbonylmethylenetriphenylphosphoranes.

Fluorinated biscarbonylmethylenetriphenylphosphoranes **1** could regiospecifically be attacked at the perfluoroacyl groups by various lithium reagents at -60 or 0 °C to form ylide-anions **2**, after protonation, the intramolecular Wittig reaction took place spontaneously to give products **4** (Eq. 1) in 93-97% yields with high stereoselectivity (67-100% E isomers) based on their NMR spectra.



(1)

1 **2** **3** **4**

In a general procedure lithium reagent (4 mmol) was added dropwise with stirring to a solution of **1** (4 mmol) in dry THF (16 ml) at -60 or 0 °C under nitrogen. The reaction mixture was stirred for 1 h and acetic acid (1 ml)

Table 1, Preparation of compounds 4

4	R	R_f	X	t(°C)[a]	yields(%)[b]	Z:E[c]	b.p.(°C/mm)
a	C_6H_5	CF_3	OCH_3	-60	93	14:86	100/0.5
b	n-C_4H_9	n-C_3F_7	OCH_3	-60	95	0:100	75/0,5
c	C_6H_5	n-C_3F_7	OCH_3	-60	97	33:67	110/0.5
d	n-C_4H_9	n-C_3F_7	SCH_3	-60	94	10:90	70/0.5
e	2-thienyl	C_2F_5	SCH_3	0	95	15:85	115/3
f	C_6H_5	C_2F_5	SCH_3	-60	90	17:83	110/2
g	CH_3	n-C_3F_7	C_6H_5	0	94	0:100	110/3
h	n-C_4H_9	n-C_3F_7	C_6H_5	-60	94	0:100	140/3
i	C_6H_5	n-C_3F_7	C_6H_5	-60	93	24:76	150/2

a) Reaction temperature of 1 with RLi; b) Isolated yields;
c) Estimated on the basis of NMR spectra.

was added. The mixture was warmed to 20 °C and stirred for 2 h. Diethyl ether (20 ml) was added. The organic layer was washed with water to neutral and dried. Evaporation of the solvent gave a residue which was purified by column chromatography on silica gel eluting with petroleum ether (bp 60-90 °C)/ethyl acetate (95/5) to afford the product 4.

The results are shown in Table 1. All products are new and characterised by microanalysis, IR, NMR and mass spectra.

In conclusion, the reaction is of wide scope, the lithium reagents may be alkyl, aryl or heterocyclic and the nucleophilic addition only occur at the perfluoroacyl group, methoxycarbonyl, methylthiocarbonyl and benzoyl groups in the same molecule are not attacked. The reaction is performed under mild conditions, giving E isomers stereoselectively and should be useful in the synthesis of biologically active compounds.

Acknowledgement The authors thank the National Natural Science Foundation of China and Academia Sinica for finanacial support.

References

1, J. T. Welch, Tetrahedron, 1987, **43**, 3123; F. Camps, R. Canela, J. Coll, A. Messeguer and A. Reca, Tetrahedron, 1978, **34**, 2179; A. E. Asato, D. Mead, M. Denny, T. F. Bopp and R. S. H. Liu, J. Am. Chem. Soc., 1982, **104**, 4979.

2, G. Makel, Chem. Ber., 1961, **94**, 3005; S.T.D. Gough and S. Trippett, J. Chem. Soc., 1962, 2333; H. J. Bestmann, Angew. Chem, Int. Ed. Engl., 1965, **4**, 645.

3. Y.-Z. Huang, Y.-C. Shen, W.-Y. Ding and J.-H. Zheng, Tetrahedron Lett., 1981, **22**, 5283; Y. Kobayashi, K. Takahashi, H. Kuroda and I. Kumadaki, ibid, 1982, **23**, 343; Y.-C. Shen, Y.-K. Lin and Y.-K. Xin, ibid, 1985, **26**, 5173; Y.-C. Shen and J.-H. Zheng, J. Fluorine Chem., 1987, **35**, 513 and the references cited therein.

4, Y.-C. Shen and T.-L. Wang, Tetrahedron Lett., 1989, **30**, 7203.

(Received in Japan 16 June 1990)