

Short Research Article

Aryl fluoroalkanesulfonate chemistry. A new approach to labelled arene elaboration[†]

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Introduction

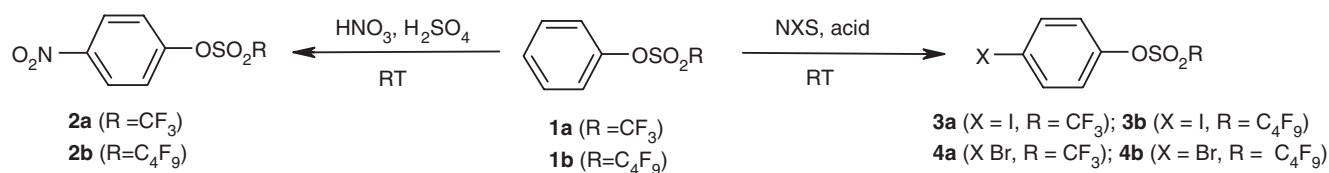
Labelled phenyl perfluoroalkanesulfonates are readily available from labelled phenol¹, and in this report, are used to construct multiply substituted labelled arenes.

Results and discussion

Nitration of **1** to give **2** was reproducible², and 4-halogenated products **3a** and **4a** were prepared by

halogenation with an *N*-halosuccinimide in sulfuric acid (Scheme 1; Table 1), in an adaptation of a reported procedure³. Attempts to carry out Friedel-Crafts acylation of **1** were unsuccessful.

Further substitution of **2** or **4** gave 1,2,4-trisubstituted arenes in good yields (Scheme 2). Halophenyl triflates **3** were further elaborated *via* the Grignard reagent formed under Knochel conditions⁴ (Scheme 2; Table 2) and it was possible to displace either bromide or triflate selectively from **4a** using previously reported methods (Scheme 2; Table 3)^{5–7}.



Scheme 1

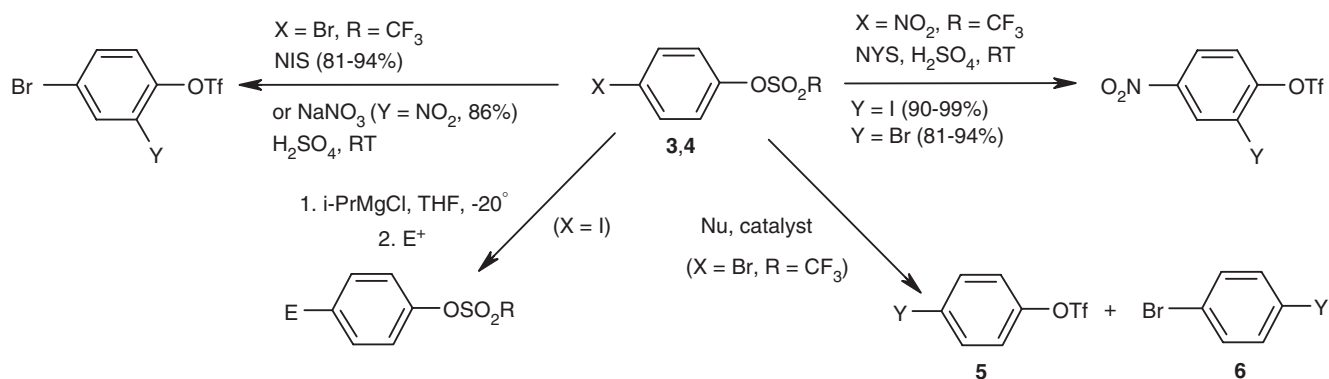
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Table 1 Electrophilic substitution reactions of **1a** and **1b**

R	Electrophile	Acid	Reaction time (h)	Yield (%)
CF ₃	HNO ₃	H ₂ SO ₄	6	90, 92
CF ₃	NIS	CF ₃ COOH or H ₂ SO ₄	4–6	89–99
CF ₃	NBS	H ₂ SO ₄	6	81, 94
C ₄ F ₉	HNO ₃	H ₂ SO ₄	4	90
C ₄ F ₉	NIS	CF ₃ COOH or H ₂ SO ₄	4–6	86–93
C ₄ F ₉	NBS	H ₂ SO ₄	20	36



Scheme 2

Table 2 Reaction of Grignard reagents derived from **3** with electrophiles

R	E ⁺ (E)	Yield (%)	R	E ⁺ (E)	Yield (%)
CF ₃	(EtCO) ₂ O (COEt)	28	CF ₃	NCCOOEt (COOEt)	68
CF ₃	1-Benzyl-4-piperidinone	29	CF ₃	Ms ₂ O (SO ₂ Me)	35
CF ₃	Benzaldehyde (CH(OH)Ph)	99	CF ₃	C ₂ Cl ₆ (Cl)	85
CF ₃	MeSO ₂ Cl (Cl)	75	C ₄ F ₉	NCCOOEt (COOEt)	60

Table 3 Metal-catalysed displacement reactions of **4a**

Nu	Catalyst	5, 6 yields	Nu [Y]	Catalyst	5, 6 yields
Zn(CN) ₂	Pd(dppf) ₂ Cl ₂	0, 100%	[(RO) ₂ B] ₂ ^a [B(OR) ₂]	Pd(dppf) ₂ Cl ₂	92%, 0
Zn(CN) ₂	Pd(OAc) ₂ , AsPh ₃	87%, 0	[(RO) ₂ B] ₂ ^a [B(OR) ₂]	Pd(OAc) ₂ , AsPh ₃	1%, 91%
Me ₂ Zn	Pd(dppe) ₂ Cl ₂	72%, 25%	[(RO) ₂ B] ₂ ^a [B(OR) ₂]	Ni(dppf)Cl ₂	50%
Me ₂ Zn	Pd(OAc) ₂ , AsPh ₃	100%, 0	Et ₃ SiH[H]	Pd(OAc) ₂ , dppp	55%

^aBis(pinacol)diborane.

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