# Supplementary Material

# Alcohols in Direct Carbon-carbon and Carbon-heteroatom Bond-forming Reactions: Recent Advances

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**Dedicated to Prof. Kenneth Laali on the occasion of his 65th birthday**

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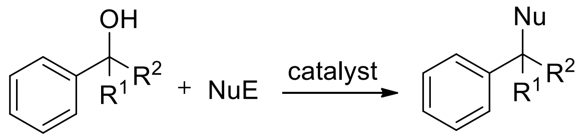
**Table 22.** Nucleophilic substitution of alcohols.



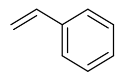
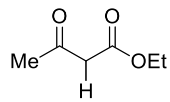
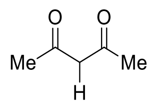
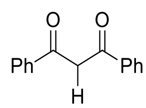
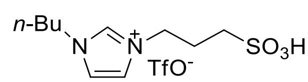
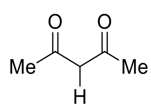
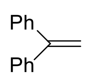
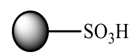
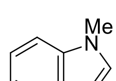
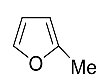
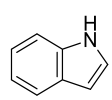

| Entry | Bond formation | $R^1$, $R^2$ | NuE | Catalyst | Yield (%) | Ref. |
|---|---|---|---|---|---|---|
| 1 | **C-C** | $R^1$ = H, $R^2$ = Ph |  | $[NMP]^+HSO_4^-$ | 90 | 1 |
| 2 | | $R^1$ = H, $R^2$ = Ph |  | PTS or TfOH | 84 | 2 |
| 3 | | $R^1$ = H, $R^2$ = Me |  | PWA | 84 | 3 |
| 4 | | $R^1$ = H, $R^2$ = Me |  |  /EMIOTf | 81 | 4 |
| 5 | | $R^1$ = H, $R^2$ = Ph |  | $Fe(HSO_4)_3$ | 80 | 5 |
| 6 | | $R^1$ = H, $R^2$ = Ph | 1-methyl-1*H*-indole, 1,3-dibenzoylmethane, 1,3,5-trimethoxybenzene, | DBSA | 82-89 | 6 |
| 7 | | $R^1$ = H, $R^2$ = Ph |  | [BsOdP][OTf] | 91 | 7 |
| 8 | | $R^1$ = H, $R^2$ = CH=CHPh | 1*H*-indole, 4-nitroaniline, 1,3,5-trimethoxybenzene, acetylacetone | PTS or  | 74-86 | 8 |
| 9 | | $R^1$ = H = $R^2$ = CCPh | ethanol, phenylmethanol, prop-2-en-1-ol | PTS | 74-80 | 9 |
| 10 | | $R^1$ = Et, $R^2$ = CCPh |  | PTSA | 78 | 10 |
| 11 | | $R^1$ = H, $R^2$ = CCPh |  | $C_6F_5B(OH)_2$ | 41 | 11 |
| 12 | | $R^1$ = $R^2$ = Ph |  | $C_6F_5B(OH)_2$ | 99 | 12 |
| 13 | | $R^1$ = H, $R^2$ = CCPh | 1*H*-indole, naphthalen-2-ol, cyclohexane-1,3-dione | Amberlite IR-120H resin | 87-90 | 13 |

**Table 22.** (Continued)

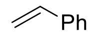
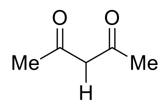
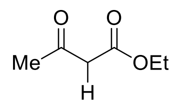
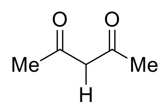
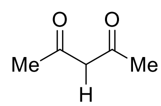
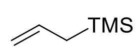
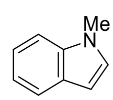
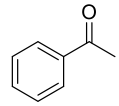
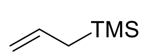
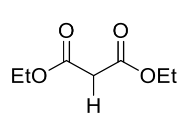
| Entry | Bond formation | $R^1$, $R^2$ | NuE | Catalyst | Yield (%) | Ref. |
|---|---|---|---|---|---|---|
| 14 | **C-C** | $R^1$ = H, $R^2$ = CH=CHPh |  | TfOH | 87 | 14 |
| 15 | | $R^1$ = H, $R^2$ = CH=CHPh | TMSCN | Sn or Ti-Monts | 98 or 94 | 15 |
| 16 | | $R^1$ = H, $R^2$ = CH=CHPh |  | $H_2SO_4$ | 87 | 16 |
| 17 | | $R^1$ = H, $R^2$ = CCPh |  | PTSA | 54 | 17 |
| 18 | | $R^1$ = H, $R^2$ = CCPh | Phenol, anisole, *o*-cresol, 2-naphtol, 1*H*-indole | PMA-$SiO_2$ | 90-96 | 18 |
| 19 | | $R^1$ = H, $R^2$ = Me |  | TfOH-$SiO_2$ | 90 | 19 |
| 20 | | $R^1$ = H, $R^2$ = Me |  | $HClO_4$ | 88 | 20 |
| 21 | | $R^1$ = H, $R^2$ = Ph | Phenol, mesitylene, 1,3-dimethoxybenzene, 1,3,5-trimethoxybenzene, naphthalen-2-ol, 1*H*-indole, 2-methylfuran, benzo[b]thiophene | $NaHSO_4$/$SiO_2$ | 59-98 | 21 |
| 22 | | $R^1$ = H, $R^2$ = CCPh |  | PTS | 73 | 22 |
| 23 | | $R^1$ = H, $R^2$ = Ph | | PMA | 90 | 23 |
| 24 | | $R^1$ = H, $R^2$ = CH=CHPh |  | Calix | 0-100 | 24 |
| 25 | | $R^1$ = H, $R^2$ = Ph |  | TfOH/$HC(OMe)_3$ | 60 | 25 |
| 26 | | $R^1$ = H, $R^2$ = Ph |  | $HBF_4$•$OEt_2$ | 67 | 26 |
| 27 | | 1-(naphthalen-2-yl)ethanol | 2-methoxynaphthalene, anisole, methylfuran, 3,4-dihydronaphthalen-1-yl acetate, styrene | $La(OTf)_3$ | 74-96 | 27 |
| 28 | | $R^1$ = H, $R^2$ = CH=CHPh |  | $InCl_3$ | 69 | 28 |

**Table 22.** (Continued)

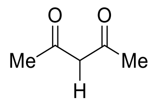
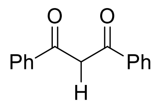
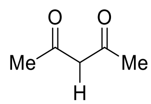
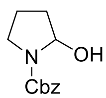
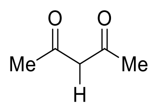
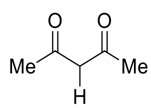
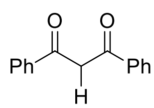
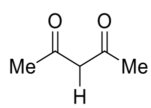
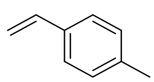
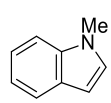
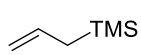
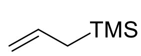
| Entry | Bond formation | $R^1$, $R^2$ | NuE | Catalyst | Yield (%) | Ref. |
|---|---|---|---|---|---|---|
| 29 | **C-C** | $R^1 = H$, $R^2 = CH{=}CHPh$ |  | $AuCl_3/AgSbF_6$ | 91 | 29 |
| 30 | | $R^1 = H$, $R^2 = Me$ |  | $Hf(OTf)_4$ | 93 | 30 |
| 31 | | $R^1 = H$, $R^2 = Ph$ |  | $Cu(OTf)_2$ | 98 | 31 |
| 32 | | $R^1 = H$, $R^2 = Ph$ | indole | $Fe(ClO_4)_3{\bullet}xH_2O$ | 92 | 32 |
| 33 | |  |  | $Sn(NTf_2)_4$ | 75 | 33 |
| 34 | | $R^1 = H$, $R^2 = Me$ |  | $FeCl_3{\bullet}6H_2O$ | 99 | 34 |
| 35 | | $R^1 = H$, $R^2 = CCPh$ |  | $[BMIM][PF_6]/Bi(NO_3)_3{\bullet}5H_2O$ or $[BMIM][PF_6]/Sc(OTf_3)_3{\bullet}5H_2O$ | 91 | 35 |
| 36 | | $R^1 = H$, $R^2 = Me$ |  | $Bi(OTf)_3$ | 91 | 36 |
| 37 | | $R^1 = H$, $R^2 = Ph$ | resorcinol, 1*H*-indole, naphthalen-2-ol | $NbCl_5$ | 86-92 | 37 |
| 38 | | $R^1 = H$, $R^2 = Ph$ | 1*H*-indole | $FeCl_3$ | 75 | 38 |
| 39 | | $R^1 = H$, $R^2 = Ph$ |  | $(CF_3CO)_2O/Pd(OAc)_2/PPh_3$ | 56 | 39 |
| 40 | | $R^1 = H$, $R^2 = Me$ |  | $[(C_6H_6)(PCy_3)(CO)RuH]^+BF_4^-$ | 94 | 40 |
| 41 | | $R^1 = H$, $R^2 = Me$ |  | $InCl_3$ | 51 | 41 |
| 42 | | $R^1 = H$, $R^2 = CH{=}CHPh$ | | $Cu(BF_4)_2$ | 86 | 42 |
| 43 | | $R^1 = H$, $R^2 = Ph$ | | $TiCl_4$ | 96 | 43 |
| 44 | | $R^1 = R^2 = Me$ | | $InCl_3/Me_3SiBr$ | 75 | 44 |
| 45 | | $R^1 = H$, $R^2 = CCH$ |  | $FeCl_3$ | 70 | 45 |
| 46 | | $R^1 = H$, $R^2 = CCH$ | | $BiCl_3$ | 89 | 46 |
| 47 | | $R^1 = H$, $R^2 = CCPh$ | | $(dppm)ReOCl_3/NH_4PF_6$ | 79 | 47 |

**Table 22.** (Continued)

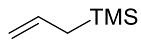
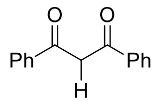
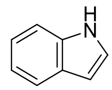
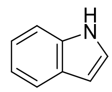
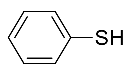
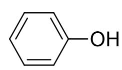
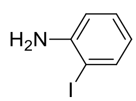
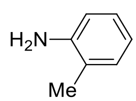
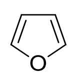
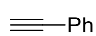
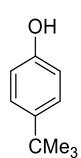
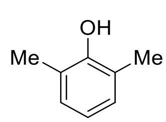
| Entry | Bond formation | $R^1$, $R^2$ | NuE | Catalyst | Yield (%) | Ref. |
|---|---|---|---|---|---|---|
| 48 | **C-C** | $R^1$ = H, $R^2$ = CCPh |  | $NaAuCl_4 \cdot 2H_2O$ | 97 | 48 |
| 49 | | $R^1$ = H, $R^2$ = CCPh | | $Bi(OTf)_3$ | 93 | 49 |
| 50 | | $R^1$ = H, $R^2$ = CH=$CH_2$ |  | $PdCl(COD)SnCl_2$ | 70 | 50 |
| 51 | | $R^1$ = H, $R^2$ = Me | 1,3-dimethoxybenzene | $Ca(NTf_2)_2$/ $Bu_4NPF_6$ | 85 | 51 |
| 52 | | $R^1$ = $R^2$ = H |  | Pt/θ-$Al_2O_3$-1.5 nm | 87 | 52 |
| 53 | | Allyl alcohol |  | $[(\eta^3\text{-allyl})Pd(cod)]BF_4$ | 80 | 53 |
| 54 | | | $CH_3CH_2OH$ | [RuCp(*o*-EtOdppe)](OTs) | 86 | 54 |
| 55 | | |  | [RuCp(*o*-EtOdppe)](OTs) | 48 | 54 |
| 56 | | |  | $[RuCp(PPh_3)_2](OTs)$ | 99 | 55 |
| 57 | | |  | $Pt(acac)_2/PPh_3/Ti(OPr^i)_4$ | 64 | 56 |
| 58 | | |  | $Pt(cod)Cl_2$/DPEphos | 86 | 57 |
| 59 | | $R^1$ = H, $R^2$ = CCH |  | $[Cp^*RuCl(\mu_2\text{-SMe})_2RuCp^*Cl]/NH_4BF_4$ | 68 | 58 |
| 60 | | $R^1$ = H, $R^2$ = CCPh | | $[Cp^*RuCl(\mu\text{-SMe})_2Cp^*Ru(OH_2)]OTf$ | 71 | 59 |
| 61 | | $R^1$ = H, $R^2$ = CCPh | | $[ReBr(CO)_3(thf)]_2$ | 37 | 60 |
| 62 | | $R^1$ = H, $R^2$ = CCPh | | $(dppm)Re(O)Cl_3/KPF_6$ | 81 | 61 |
| 63 | | $R^1$ = H, $R^2$ = CH=CHPh |  | $Cu(OTf)_2$ | 78 | 62 |
| 64 | | $R^1$ = H, $R^2$ = CH=$CH_2$ | *p*-xylene | $Ag_3PW_{12}O_{40}$ | 84 | 63 |
| 65 | | $R^1$ = H, $R^2$ = CH=CHPh |  | $SbCl_3$ | 67 | 64 |
| 66 | | $R^1$ = Ph, $R^2$ = CCPh |  | $Yb(OTf)_3$ | 90 | 65 |

**Table 22.** (Continued)

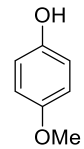
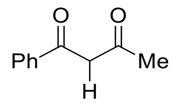
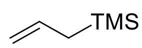
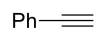
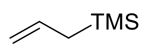
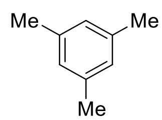
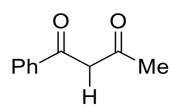
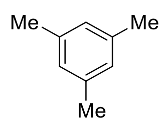
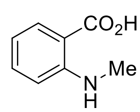
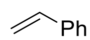
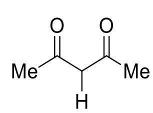
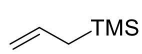
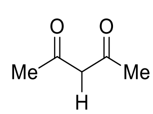
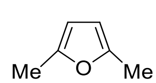
| Entry | Bond formation | $R^1$, $R^2$ | NuE | Catalyst | Yield (%) | Ref. |
|---|---|---|---|---|---|---|
| 67 | **C-C** | $R^1$ = H, $R^2$ = Me |  | $Bi(OTf)_3$ | 58 | 66 |
| 68 | | $R^1$ = H, $R^2$ = Ph |  | $[CHCl][ZnCl_2]_2$ | 96 | 67 |
| 69 | | $R^1$ = H, $R^2$ = Ph |  | $FeCl_3 \bullet 6H_2O$ | 98 | 68 |
| 70 | | $R^1$ = H, $R^2$ = Ph |  | $Fe(OTf)_3$/TfOH | 77 | 69 |
| 71 | | $R^1$ = H, $R^2$ = CCPh |  | $NaAuCl_4 \bullet 2H_2O$ | 97 | 70 |
| 72 | | $R^1$ = H, $R^2$ = CCPh |  | $AuBr_3$ | 80 | 71 |
| 73 | | $R^1$ = H, $R^2$ = Me |  | Ir-$Sn_3$ complex | 90 | 72 |
| 74 | | $R^1$ = H, $R^2$ = Me |  | $[Fe(TPP)]SbF_6]$ | 92 | 73 |
| 75 | | $R^1$ = H, $R^2$ = CH=CHPh |  | $Co(hfac)_2 \bullet xH_2O$/TPPMS | 77 | 74 |
| 76 | | $R^1$ = H, $R^2$ = Ph |  | $FeCl_3 \bullet 6H_2O$/TsOH | 66 | 75 |
| 77 | | $R^1$ = H, $R^2$ = Me |  | *cis*-$[Ru(6,6'\text{-}Cl_2bipy)_2(H_2O)_2](ClO_4)_2$ | 82 | 76 |
| 78 | | $R^1$ = H, $R^2$ = CH=CHPh |  | $I_2$ | 94 | 77 |
| 79 | | $R^1$ = H, $R^2$ = CCPh |  | | 96 | 78 |
| 80 | | $R^1$ = H, $R^2$ = Me |  | | 99 | 79 |
| 81 | | $R^1$ = H, $R^2$ = CCPh | Phenol | | 90 | 80 |
| 82 | | $R^1$ = $R^2$ = H | Anisole | | 88 | 81 |
| 83 | | $R^1$ = H, $R^2$ = Me |  | | 78 | 79 |

**Table 22.** (Continued)

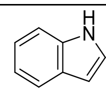
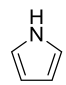
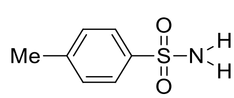
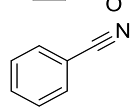
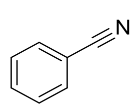
| Entry | Bond formation | $R^1$, $R^2$ | NuE | Catalyst | Yield (%) | Ref. |
|---|---|---|---|---|---|---|
| 84 | | $R^1 = R^2 = Ph$ |  | $I_2$ | 98 | 82 |
| 85 | | $R^1 = H$, $R^2 = CH{=}CHPh$ | anisole, phenol, indole, TMSNu, $RNH_2$, acetylacetone | HFIP or TFE[a] | 51-98 | 83 |
| 86 | | 1-(Ferrocenyl)ethanol | 1*H*-indole, 1H-pyrrole, acetylacetone, ethyl 3-oxobutanoate | $H_2O$[b] | 48-90 | 84 |
| 87 | | $R^1 = H$, $R^2 = CCPh$ |  | PIFA | 61 | 85 |
| 88 | | $R^1 = H$, $R^2 = Ph$ | $Ac_2O$ | NBS | 95 | 86 |
| 89 | **C-N** | $R^1 = H$, $R^2 = Ph$ | benzyl carbamate | DBSA | 84 | 6 |
| 90 | | $R^1 = H$, $R^2 = CCPh$ | benzenesulfonamide | PTS | 67 | 9 |
| 91 | | $R^1 = HF_2C$, $R^2 = H$ | MeCN | $H_2SO_4$ | 55 | 87 |
| 92 | | $R^1 = H$, $R^2 = CCPh$ | 4-methylbenzamide | Amberlite IR-120H resin | 90 | 13 |
| 93 | | $R^1 = H$, $R^2 = Me$ | MeCN | DNBSA | 82 | 88 |
| 94 | | 2-methylpropan-2-ol | MeCN | $[BMIM(SO_3H)][OTf]$ | 95 | 89 |
| 95 | | $R^1 = H$, $R^2 = Me$ | PhCN | Nanocat.-Fe-$OSO_3H$ | 84 | 90 |
| 96 | | $R^1 = H$, $R^2 = Ph$ | MeCN | $CoFe_2O_4@SiO_2$-DASA | 90 | 91 |
| 97 | | $R^1 = H$, $R^2 = Ph$ | $CH_2{=}CH{-}CH_2CN$ | $NaHSO_4/SiO_2$ | 84-87 | 92 |
| 98 | | $R^1 = H$, $R^2 = Me$ | MeCN | PFPAT | 95 | 93 |
| 99 | | $R^1 = R^2 = Me$ | MeCN | TfOH/SDS | 82 | 94 |
| 100 | | $R^1 = H$, $R^2 = CCPh$ | Benzenesulfonamide, benzamide | $FeCl_3$ | 73-82 | 45 |
| 101 | | $R^1 = H$, $R^2 = CCPh$ |  | $BiCl_3$ | 80 | 46 |
| 102 | | Adamantanol |  | $Bi(OTf)_3$ | 91 | 95 |
| 103 | | $R^1 = H$, $R^2 = Ph$ | MeCN | $(Mes_3P)AuNTf_2$ | 70 | 96 |
| 104 | | $R^1 = H$, $R^2 = Me$ |  | $Ca(OTf)_2/Bu_4NPF_6$ | 93 | 97 |
| 105 | | $R^1 = H$, $R^2 = Ph$ | 4-nitroaniline, 4-methylbenzenesulfonamide, benzamide | $[CHCl][ZnCl_2]_2$ | 92-95 | 67 |

**Table 22.** (Continued)

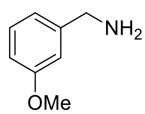
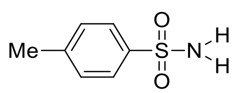
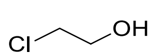
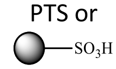
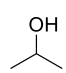
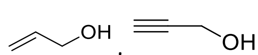
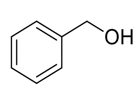
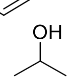
| Entry | Bond formation | $R^1$, $R^2$ | NuE | Catalyst | Yield (%) | Ref. |
|---|---|---|---|---|---|---|
| 106 | | $R^1 = R^2 = H$ | Ph-$NH_2$ | Ru (II) pincer complex | 92 | 98 |
| 107 | | $R^1 = H$, $R^2 = CH{=}CHPh$ | benzyl carbamate | $Al(OTf)_3$ | 92 | 99 |
| 108 | | $R^1 = R^2 = H$ | 4-chloroaniline | NiCuFeOx | 76 | 100 |
| 109 | | $R^1 = R^2 = Me$ | 4-nitroaniline | $Ca(NTf_2)_2/Bu_4NPF_6$ | 87 | 101 |
| 110 | | $R^1 = R^2 = H$ | Ph-$NH_2$ | $[Cp^*IrCl_2]_2/NaHCO_3$ | 93 | 102 |
| 111 | | $R^1 = R^2 = H$ | Ph-$NH_2$ | $[Ru(p\text{-cymene})Cl_2]_2$/DPEphos | 91 | 103 |
| 112 | | $R^1 = R^2 = H$ | Ph-$NH_2$ | $Pd/Fe_2O_3$ | 90 | 104 |
| 113 | | $R^1 = R^2 = H$ | Ph-$NH_2$ | $[Cp^*Ir(NH_3)_3][I]_2$ | 92 | 105 |
| 114 | | $R^1 = R^2 = H$ | Ph-$NH_2$ | $[IrCl(cod)]_2$/ $Py_2NP\textit{i}Pr_2$ | 92 | 106 |
| 115 | | $R^1 = R^2 = H$ | Ph-$NH_2$ | $Ru(OH)_3\text{-}Fe_3O_4$ | 99 | 107 |
| 116 | | $R^1 = R^2 = H$ |  | $FeBr_3$/DL-pyroglutamic acid/Cp*H | 77 | 108 |
| 117 | | $R^1 = H$, $R^2 = CH{=}CH_2$ | | $Pd(Xantphos)Cl_2$ | 72 | 109 |
| 118 | | $R^1 = H$, $R^2 = Ph$ | $PhCONH_2$ | $I_2$ | 98 | 110 |
| 119 | | $R^1 = H$, $R^2 = Me$ | $MeCN/H_2O$ | | 85 | 111 |
| 120 | | $R^1 = H$, $R^2 = CH{=}CHPh$ |  | | 85 | 112, 113 |
| 121 | | $R^1 = H$, $R^2 = Ph$ | amides, anilines | H-mont | 39-94 | 114 |
| 122 | | $R^1 = H$, $R^2 = Ph$ | $TMSN_3$ | TMSCl/Na-Mont | 98 | 115 |
| 123 | **C-O** | $R^1 = H$, $R^2 = CH{=}CHPh$ |  | PTS or  | 83 | 8 |
| 124 | | $R^1 = R^2 = Me$ | $CH_3(CH_2)_3OH$ | $NaHSO_3$ | 48 | 116 |
| 125 | | cyclohexanol | methyl *tert*-butyl ether | $H_2SO_4^c$ | 79 | 117 |
| 126 | | $R^1 = H$, $R^2 = Ph$ |  | TeaMs | 75 | 118 |
| 127 | | $R^1 = H$, $R^2 = Ph$ |  | $NbCl_5$ | 93-95 | 37 |
| 128 | | $R^1 = H = R^2 = CCPh$ |  | $FeCl_3$ | 91 | 45 |
| 129 | | $R^1 = H = R^2 = CC^nBu$ |  | $BiCl_3$ | 66 | 46 |
| 130 | | Allyl alcohol | $CH_3CH_2OH$ | $[RuCp(o\text{-EtOdppe})](OTs)$ | 86 | 54 |

**Table 22.** (Continued)

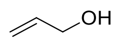
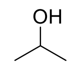
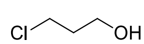
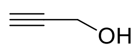
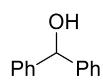
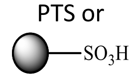
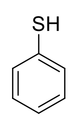
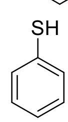
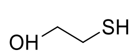
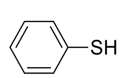
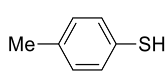
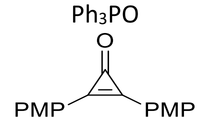
| Entry | Bond formation | $R^1$, $R^2$ | NuE | Catalyst | Yield (%) | Ref. |
|---|---|---|---|---|---|---|
| 131 | **C-O** | $R^1$ = H, $R^2$ = Ph | $Ph-C\equiv C-CH_3$ | $Pd(PPh_3)_4/PhCO_2H$ | 85 | 119 |
| 132 | | $R^1$ = H, $R^2$ = Ph | $Ph-C\equiv C-CH_3$ | $Pd(PPh_3)_4$ | 85 | 120 |
| 133 | | $R^1$ = H, $R^2$ = Ph | *i*PrOH | $PdCl_2$ | 86 | 121 |
| 134 | | $R^1$ = H, $R^2$ = Ph |  | $PdCl_2(CH_3CN)_2$ | 71 | 122 |
| 135 | | $R^1$ = H, $R^2$ = Ph |  | $NaAuCl_4$ | 56 | 123 |
| 136 | | $R^1$ = H, $R^2$ = $CC^nBu$ |  | $(dppm)ReOCl_3$ | 96 | 124 |
| 137 | | $R^1$ = H, $R^2$ = Ph | MeOH | $Fe(NO_3)_3\bullet 9H_2O$ | 88 | 125 |
| 138 | | $R^1$ = Me, $R^2$ = CC | EtOH | $[Fc]PF_6$ | 67 | 126 |
| 139 | | $R^1$ = H, $R^2$ = Me | 2-methylpropan-1-ol | $AuClPPh_3/AgSbF_6$ | 53 | 127 |
| 140 | | $R^1$ = H, $R^2$ = Ph |  | $I_2$ | 95 | 128 |
| 141 | | $R^1$ = $R^2$ = H |  | $Ph_2CHBr$ | 90 | 129 |
| 142 | | $R^1$ = H, $R^2$ = CCPh | EtOH | PIFA | 83 | 85 |
| 143 | **C-S** | $R^1$ = H, $R^2$ = Ph | benzenethiol | DBSA | 83 | 6 |
| 144 | | $R^1$ = H, $R^2$ = CH=CHPh | dodecylthiol | PTS or  | 81 | 8 |
| 145 | | $R^1$ = H = $R^2$ = CCPh | $CH_3(CH_2)_{11}SH$ | PTS | 80 | 9 |
| 146 | | $R^1$ = H, $R^2$ = Ph | , $NH_4SCN$ | $NbCl_5$ | 90-95 | 37 |
| 147 | | $R^1$ = H, $R^2$ = Ph | ,  | $FeCl_3$ | 93-94 | 45 |
| 148 | | Allyl alcohol |  | [RuCp(*o*-EtOdppe)](OTs) | 48 | 54 |
| 149 | | (E)-4-phenylbut-3-en-2-ol |  | $I_2$ | 92 | 130 |
| 150 | | $R^1$ = H, $R^2$ = CCPh | PhSH | PIFA | 92 | 85 |
| 151 | **C-OTMS** | $R^1$ = H, $R^2$ = H | HMDS | $LiClO_4$ | 99 | 131 |
| 152 | | $R^1$ = H, $R^2$ = Ph | | $LaCl_3$ | 93 | 132 |

**Table 22.** (Continued)

| Entry | Bond formation | $R^1$, $R^2$ | NuE | Catalyst | Yield (%) | Ref. |
|---|---|---|---|---|---|---|
| 153 | **C-OTMS** | $R^1$ = H, $R^2$ = Ph | HMDS | $I_2$ | 87 | 133 |
| 154 | **C-CN** | $R^1$ = H, $R^2$ = CH=CHPh | TMSCN | $Zn(OTf)_2$ | 77 | 134 |
| 155 | | $R^1$ = H, $R^2$ = $CH=CHCH_3$ | | $InBr_3$ | 86 | 135 |
| 156 | **C-Cl** | $R^1$ = H, $R^2$ = H | $HSiMe_2Cl$/benzil | $InCl_3$ | 80 | 136 |
| 157 | | 2-methylhexan-2-ol | $HSiMe_2Cl$ | $GaCl_3$/diethyltartrate | 99 | 137 |
| 158 | | (3-nitrophenyl)methanol | TsCl/TEA | DMAP | 35 | 138 |
| 159 | | $R^1$ = H, $R^2$ = Ph | $(COCl)_2$ | $Ph_3PO$ | 96 | 139 |
| 160 | | $R^1$ = $R^2$ = H | $(COCl)_2$ |  | 84 | 140 |
| 161 | | $R^1$ = H, $R^2$ = Me | TMSCl | Na-Mont | 60 | 141 |
| 162 | **C-Br** | $R^1$ = H, $R^2$ = Me | LiBr/$(COCl)_2$ | $Ph_3PO$ | 74 | 139 |

[a]HFIP or TFE were used as solvents and promoters.
[b]$H_2O$ was used as solvent.
[c]$H_2SO_4$ (10 mmol).

## References

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