

Ni-Catalyzed Defluorophosphonylation of Aryl Fluorides

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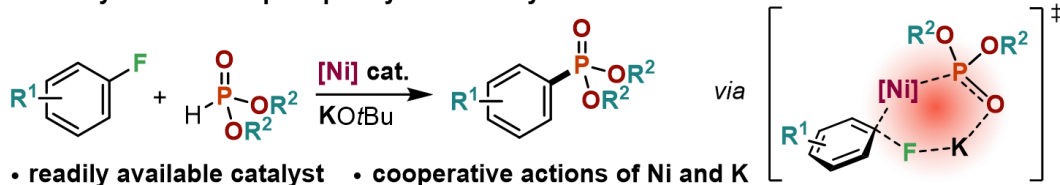
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Since organofluorine compounds are markedly abundant as pharmaceuticals and functional materials, direct C–F bond functionalization is receiving growing attentions as a strategy for synthesizing complex molecules by late-stage functionalization.¹ In this context, the reaction transforming *sp*²-C–F bonds into C–P bonds remains underdeveloped. The traditional nucleophilic aromatic substitution (S_NAr) approach requires hazardous alkali metals to generate phosphide anions. Pronucleophiles are generally limited to secondary phosphine oxides and phosphines producing electron-rich P-nucleophiles,² diorganophosphites [HPO(OR)₂] being hardly converted into the corresponding arylphosphonates. The defluorophosphonylation was only achieved by photoinduced activation of *sp*²-C–F bond through single electron transfer (SET).³ However, the protocol requires ultraviolet light (λ = 254 nm) and a strong base, limiting its accessibility and large-scale productivity.

Herein, we report a Ni-catalyzed defluorophosphonylation reaction between aryl fluorides and diorganophosphites in the presence of a stoichiometric potassium *tert*-butoxide base. Commercially available Ni(0) or Ni(II) complexes are employed as catalyst precursors. The current defluorophosphonylation protocol requires no exogenous ligand, converting a broad scope of aryl fluorides to the corresponding aryl phosphonates. Interestingly, the present defluorophosphonylation reaction occurred specifically with alkylphosphites with secondary *O*-alkyl groups. Furthermore, the reaction could readily be scaled up. The post-functionalization of pharmaceutical compounds has been demonstrated. Mechanistic studies combining kinetic experiments and theoretical investigations suggested a catalytic cycle which involves a turnover-limiting oxidative addition of aryl fluorides to a Ni(0) complex coordinated with potassium diorganophosphinites [KOP(OR)₂]. The cooperative action of a Ni(0)-K⁺ bimetallic system is crucial for the current defluorophosphonylation reaction.

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