Phosphine-Catalyzed Three-Component Coupling of Acyl Fluorides, Alkynes, and Silyl Nucleophiles

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Keywords: Phosphine-Catalyst; Acyl Fluoride; Silyl Nucleophile; Three-Component Coupling

Catalysis by late transition metal complexes is enabled by their facile reversible redox reactivity based on their partially filled d-orbitals. The realization of such redox catalysis by p-block elements is a challenging but rewarding research subject for the advancement in both fundamental main group chemistry and sustainable catalytic technology.[1] In this context, a P(III)/P(V) redox cycle that involves pentacoordinate phosphorane is a competent manifold for applications to catalytic reactions via a formal oxidative addition/transmetalation/reductive elimination sequence. Despite the promising stoichiometric redox reactivity of pentacoordinate organophosphorus compounds,[2] their use in catalytic processes have been primarily limited to oxygen transfer reactions that involve the interconversion between phosphines and phosphine oxides, except for relatively simple, prototypical transformation, such as hydrogenation[3] and reduction of allyl bromides.[4] In this presentation, we report on the phosphine-catalyzed three-component coupling of acyl fluorides, alkynes, and silyl nucleophiles.[5] The key to the success of the reaction is the formal transmetalation between pentacoordinate P(V) species (i.e., fluorophosphorane) and a silyl nucleophile.

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