Synthetic Applications of Stryker’s Reagent

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Introduction

Hexa-μ-hydrohexakis(triphenylphosphine) hexacopper, also known as Stryker’s reagent, is a well-characterized copper(I) hydride reagent for chemoselective conjugate reduction of α,β-unsaturated ketones,1–7 esters,1,4 lactones,8 nitriles,9 aldehydes,3 sulfones, and sulfonates.6 The reaction is highly chemoselective, and isolated alkenes, halogens, and typical oxygenated functionalities are not reduced under the reaction conditions.1–7 In the presence of several silanes and a catalytic quantity of Stryker’s reagent, ketones and aldehydes are reduced to the corresponding alcohols.10 The conjugated reduction can be performed either stoichiometrically or catalytically in the presence of reducing agents, and the reaction intermediates can be used for further C–C bond formations.9,11–14 Stryker’s reagent is commercially available, but various methods have been developed over the years for its preparation.15–19

Abstract

(A) A catalytic quantity (≤ 5 mol% in copper) of Stryker’s reagent in the presence of silanes [PhMe2SiH, MePh2SiH, or (t-Bu)Ph2SiH] is an efficient reaction condition for the reduction of non-conjugated aldehydes or ketones to the corresponding silyl ethers or alcohols (basic workup is necessary) in high yields (89–98%).10

(B) With Stryker’s reagent, the conjugate reduction of nitroalkenes is followed by intramolecular aldol reaction (Henry reaction) to produce β-nitroalcohols in modest to good yield.12
(C) Stoichiometric or catalytic amounts of Stryker's reagent can be used with polymethylhydrosiloxane to promote the tandem conjugate reduction–intramolecular aldol reaction of alkynones to generate β-hydroxyenones.\(^{(11)}\)

(D) A conjugate reduction with Stryker's reagent to form copper enolates, followed by an intramolecular aldol reaction, was used in the efficient one-pot generation of five- and six-membered carboycles. This methodology has provided \(\text{efficient one-pot generation of five- and six-membered carboycles. This methodology has provided}
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(E) Stryker's reagent allows for the stoichiometric conjugate reduction of \(\alpha,\beta\)-unsaturated ketones or lactones without affecting isolated alkenes, carbonyl groups, halogens or typical oxygenated functionalities under the reaction conditions.\(^{(1–4)}\)

(F) Selective reduction of alkynes to the corresponding alkenes can also be achieved with Stryker's reagent. Terminal alkynes can be reduced at room temperature, while unactivated internal alkynes react only at elevated temperatures. Protection of propargylic hydroxyketones dia-

References