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Scandium-catalyzed deoxygenation of alcohols and ketones using hydrosilanes as reductants

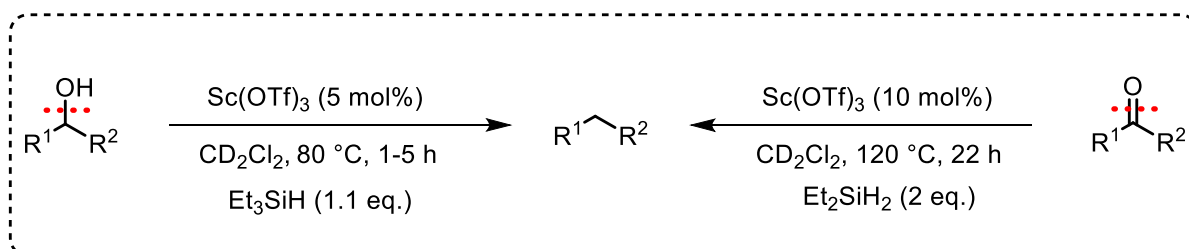
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Given the depletion of oil reserves and the urgency of combating climate change, enhancing energy efficiency and resource utilization in chemical processes is paramount for sustainable development. Among these efforts, the targeted conversion of abundant functional groups found in nature is pivotal in improving organic synthesis efficiency.^[1] A crucial aspect lies in the deoxygenation reaction of alcohols, which facilitates the conversion of biomass-derived alcohols into environmentally friendly fuels by cleaving C–O bonds.^[2] Deoxygenation methods typically fall into single-step and two-step strategies. While two-step approaches, such as the Barton-McCombie radical pathway, are prevalent, they often involve intermediate steps before reduction. Overcoming the challenges of direct deoxygenation, such as high C–O bond dissociation energy and kinetic barriers, is achievable through catalytic transition metal complexes^[3] and acid activation^[4] of hydroxyl groups.

Despite advancements, challenges remain, particularly in single-step deoxygenation, regarding the scope and site-selectivity of hydroxyl groups as well as the demand for milder conditions and enhanced efficiency. Addressing these challenges, we have developed a straightforward and effective method for alcohol and ketone deoxygenation employing Sc(OTf)₃ as a catalyst alongside hydrosilanes as reductants. Secondary and tertiary alcohols were efficiently reduced to their corresponding alkanes, while primary alcohols remained inert. Ketones, posing greater difficulty compared to alcohols, require 2 equivalents of hydrosilane and longer reaction times at elevated temperatures. Remarkably, alcohols could be selectively reduced in the presence of ketones, showcasing its versatility and applicability in complex reaction environments.



References

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