SYNLETT
Spotlight 384

This feature focuses on a reagent chosen by a postgraduate, highlighting the uses and preparation of the reagent in current research

Zinc Borohydride

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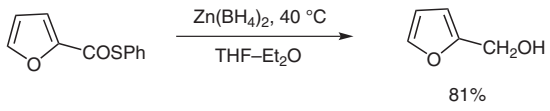
Introduction

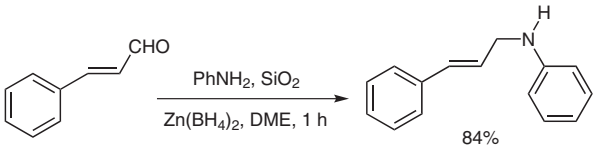
Zinc borohydride is a neutral reagent employed for the reduction of several types of carbonyl compounds. It is commercially available, but it is also easily prepared by reacting $ZnCl_2$ with $NaBH_4$.[1] Kotsuki et al. described the selective reduction of thioesters in the presence of other functional groups using $Zn(BH_4)_2$[1] and Oishi and Nakata described the reduction of chiral β-keto esters with $Zn(BH_4)_2$ leading to the corresponding alcohols with high stereoselectivity.[2] This Spotlight summarizes further reactions of zinc borohydride.

Abstracts

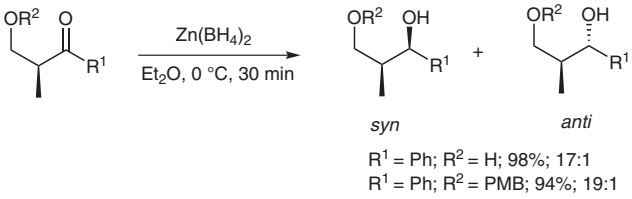
(A) Kotsuki et al. reported a facile method to selectively reduce various benzenethiol esters to the corresponding alcohols in high yields.[1]



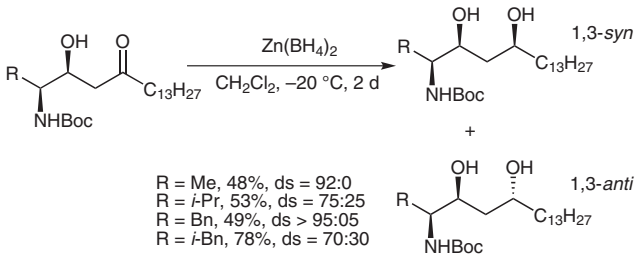
(B) The addition of a solution of $Zn(BH_4)_2$ in diethyl ether to a mixture of carbonyl, amine and silica gel is an efficient methodology for the reductive amination of α,β-unsaturated aldehydes and ketones. Ranu et al. developed a one-pot reaction for the formation of imines and an in situ subsequent reduction leading to alkylated amines.[3]



(C) Yakura et al. reported the reaction of β-hydroxyphenyl ketones and β-benzyletherphenyl ketones with zinc borohydride to yield the corresponding *syn* alcohols stereoselectively in high yields.[4]

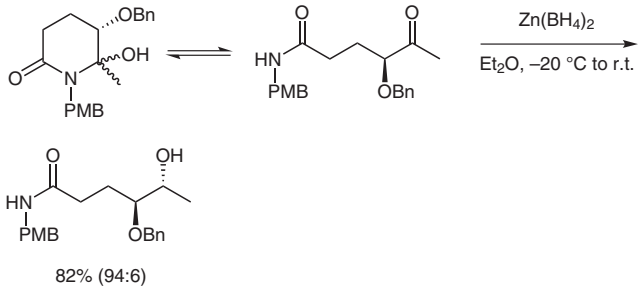


(D) Dias et al. developed the reduction of 4-*N*-Boc-amino-3-hydroxy ketones with $Zn(BH_4)_2$ to obtain 1,3-*syn* diols in moderate to high levels of diastereoselectivity and in good yields.[5]



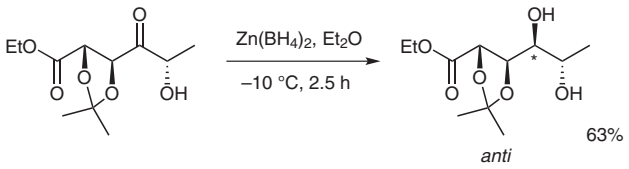
SYNLETT 2012, 23, 642–643
Advanced online publication: 13.02.2012
DOI: 10.1055/s-0031-1290334; Art ID: V39011ST

(E) Liu et al. described the use of zinc borohydride as a selective reducing agent. The treatment of a mixture of 6-alkyl-5-benzyloxy-6-hydroxy-2-piperidones and their chain tautomers with $Zn(BH_4)$ led exclusively to the corresponding ring-opening products in high *anti* diastereoselectivities.[6]



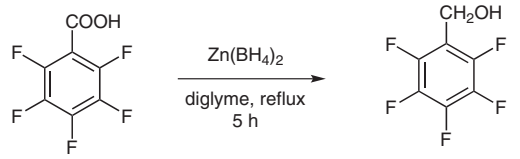
82% (94:6)

(F) Targeting the enantioselective synthesis of the antitumor natural product anamarine, Gao and O'Doherty treated the α-hydroxy ketone with zinc borohydride leading to the *anti* diol as major product in a 5:1 ratio.[7]

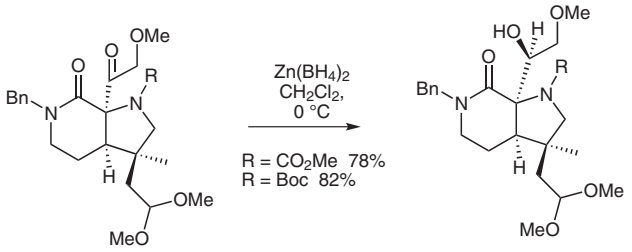


anti

(G) Zhang et al. reported an economical and effective synthesis of polyfluorinated benzyl alcohols, important intermediates in the synthesis of pharmaceutical and other kind of materials, from adequate substituted polyfluorobenzenes with zinc borohydride in diglyme.[8]



(H) Towards the total synthesis of the marine alkaloid sarain A, Hong and colleagues employed $Zn(BH_4)_2$ as reduction agent of two important intermediates. They observed the reduction of the ketone carbonyl in good yields leading to the single stereoisomer.[9]



References

(1) Kotsuki, H.; Yoshimura, N.; Ushio, Y.; Ohtsuka, T.; Ochi, M. *Chem. Lett.* **1986**, 1003.
(2) Oishi, T.; Nakata, T. *Acc. Chem. Res.* **1984**, *17*, 338.
(3) Ranu, B. C.; Majee, A.; Sarkar, A. *J. Org. Chem.* **1998**, *63*, 370.
(4) Yakura, T.; Yoshimoto, Y.; Ishida, C.; Mabuchi, S. *Tetrahedron* **2007**, *63*, 4429.
(5) Dias, L. C.; Fattori, J.; Perez, C. C.; de Oliveira, V. M.; Aguilar, A. M. *Tetrahedron* **2008**, *64*, 5891.
(6) Liu, L. X.; Xião, K. J.; Huang, P. Q. *Tetrahedron* **2009**, *65*, 3834.
(7) Gao, D.; O'Doherty, G. A. *J. Org. Chem.* **2005**, *70*, 9932.
(8) Zhang, D.; Chen, Z.; Cai, H.; Zou, X. *J. Fluorine Chem.* **2009**, *130*, 938.
(9) Hong, S.; Yang, J.; Weinreb, S. M. *J. Org. Chem.* **2006**, *71*, 2078.