Nano-iron oxide as catalyst and supports in fine chemical synthesis

Feng Shi, a Man Kin Tse, a,b Shaolin Zhou, a Marga-Matina Pohl, c Angelika Brü ckner c and Matthias Beller a,b,*

a Leibniz-Institut für Katalyse e.V. an der Universität Rostock, Albert-Einstein-Str. 29a, 18059 Rostock, Germany;
b University of Rostock, Center for Life Science Automation (CELSICA), Friedrich-Barnewitz-Str. 8, D-18119 Rostock-Warnemünde, Germany;
c Leibniz-Institut für Katalyse e.V. an der Universität Rostock, Außenstelle BerlinRichard-Willstä tter-Str. 3, 12489 Berlin, Germany
Fax: +49-381-1281-5000; Tel.: +49-381-1281-0; E-mail: matthias.beller@catalysis.de

Iron catalysis has become an important topic in catalysis in the last decade. 1 Iron complexes are cheap, easily available, and most often relatively less toxic. Traditionally, iron has been used as Lewis acid catalyst in homogeneous catalysis or as catalyst or support in heterogeneous catalysis, which was usually performed at high temperature or pressure. However, more recently an increasing number of iron-catalyzed reactions, which precede under milder reaction conditions, have been reported. Among the different iron complexes, iron oxides have been often considered to be inactive under mild reaction conditions. However, some of them can be used as magnetically separable support.

Recently, we have shown that nano-iron oxide is an active and selective catalyst for alcohol and olefin oxidations to yield the corresponding aldehydes. 2 Here, the application of nano-iron oxide in oxidation and dehydrogenation of alcohols will be presented for the first time (Scheme 1a, b). In addition, the preparation of nano-iron oxide supported nano-noble metal catalysts and their catalytic activity in fine chemical synthesis, i.e. coupling of primary alcohol and sulfonamides, Scheme 1c, will be also discussed.

![Scheme 1](image)

R nano-iron oxide + 30wt% H2O2 R CHO  a

R nano-iron oxide  b

R1 OH + H2N S=O-R2 → M/Iron oxide/Base M=Ru, Rh, Ir

R1 N=S=O-R2 + R1N=S=O-R2  c

Scheme 1. Selective oxidation of alcohols (a), dehydrogenation of alcohols (b) and coupling reaction of alcohols with sulfonamides (c)

More specifically for oxidation and dehydrogenation of alcohols, up to 30-50% conversion with >90% selectivity could be obtained. For the coupling of alcohols and sulfonamides, which are important pharmaceutical intermediates, ~25 sulfonamides were successfully synthesized with 80-99% isolated yield.

References