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Tuning of catalytic sites in mesoporous CuNiO2 for furfural hydrogenation

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PURPOSE OF THE ABSTRACT

Furfural (FF) is a lignocellulosic biomass-derived precursor molecule, which can be converted into numerous value-added chemicals [1]. The aldehyde group and the furan ring are the two functionalities responsible for the high chemical reactivity, including reduction to furfuryl alcohol (FA) or tetrahydrofurfuryl alcohol (THFA). FA has the largest application in the resin manufacture and THFA is a green solvent used in agricultural applications [2].
The hydrogenation of FF is normally catalyzed by transition metals, including both noble metals and cheap and abundant metals like Cu, Ni and Co. Most of these catalysts can hydrogenate both the C=C of the furan ring and the C=O of the aldehyde group. However, control of the relative activity in the C=O/C=C hydrogenation remains a key theme in the design of selective hydrogenation catalysts [3].
Herein, mesoporous CuNiO2 has been synthesized by nanocasting method using KIT-6 as template. CuNiO2 was reduced at different conditions allowing tuning the formation of active sites for hydrogenation. The best catalyst achieved 98% FA yield and 97% THFA yield under different reaction conditions (Figure 1), thus realizing control of selective aldehyde group hydrogenation or both aldehyde group and furan ring hydrogenation.
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FIGURES

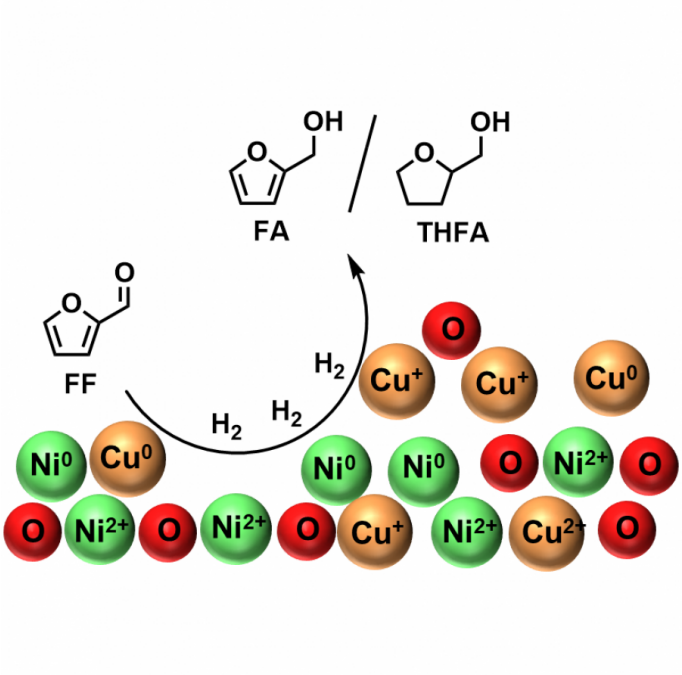

FIGURE 1

Figure 1

The conversion of furfural to furfuryl alcohol or tetrahydrofurfuryl alcohol over reduced mesoporous CuNiO2

FIGURE 2

KEYWORDS

biomass conversion | furfural | hydrogenation | metal oxide

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