Hydrodeoxygenation of Stearic Acid on Bimetallic Ni_xCu_{1-x} Catalysts Supported on ZrO_2

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Abstract

Several combination of the metal (mainly transition and noble metals) and the support partner (SiO_2, ZrO_2)[1a] depending from the actual substrate (*e.g.* long chain fatty acids) have been presented already in the literature for hydrogenation/hydrodeoxygenation (HDO) reaction.[1b] Hydrodeoxygenation of stearic acid (as a model compound of algae oil) to *n*-heptadecane on Ni/ZrO_2 proceeds *via* hydrodeoxygenation of stearic acid to 1-octadecanal with subsequent decarbonylation of the aldehyde to *n*-heptadecane (**Figure 1**).
Within our study we have investigated the impact of Cu on Ni/ZrO_2 based catalysts. It has been observed that the addition of Cu to Ni/ZrO_2 enhanced the total reaction rate. Cu/ZrO_2 was more active for the hydrodeoxygenation of stearic acid to aldehyde than Ni/ZrO_2. Decarbonylation of 1-octadecanal that is in equilibrium with 1-octadecanol proceeded, however, with a much higher rate on Ni/ZrO_2 or Ni_xCu_{1-x}/ZrO_2. The combination of the higher hydrodeoxygenation of the acid to the aldehyde or alcohol and the high rate of elimination of water on Ni or Ni_xCu_{1-x} lead to the superior properties of the newly synthesized catalyst.

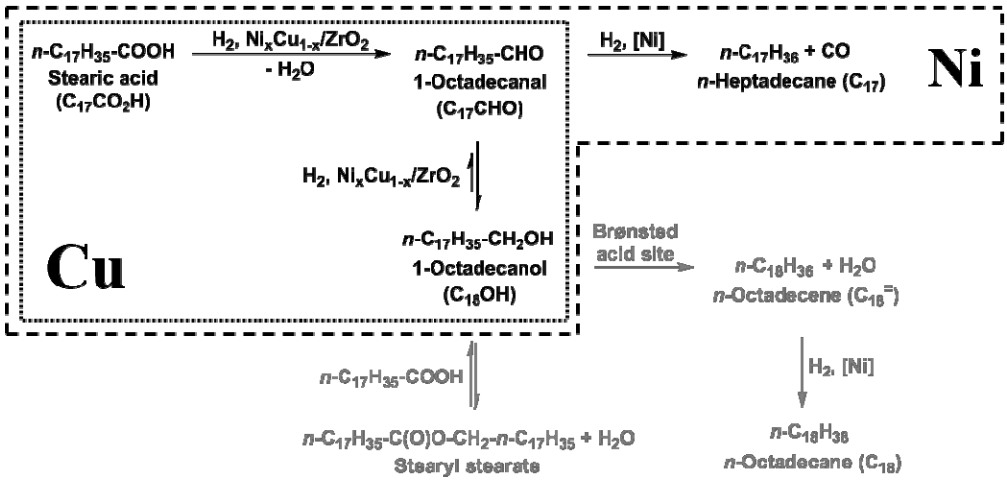

Figure 1. Hydrodeoxygenation reaction sequence of stearic acid on Ni_xCu_{1-x}/ZrO_2.

[1] (a) S. Foraita, Y. Liu, G. H. Holler, E. Baráth, C. Zhao, J. A. Lercher, *ChemCatChem* **2017**, *9*, 195-203. (b) S. Foraita, J. L. Fulton, Z. A. Chase, A. Vjunov, P. Xu, E. Baráth, D. M. Camaioni, C. Zhao, J. A. Lercher, *Chem. Eur. J.* **2015**, *21*, 2423-2434.