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Defence announcement

Public Defence on 17 May 2024

Noble metal catalysts for the hydrotreatment of renewable feedstocks to fuels

Title of the doctoral thesis	Noble metal catalysts for the hydrodeoxygenation and hydrodenitrogenation of fatty amides
Content of the doctoral thesis	The development of active catalysts for simultaneous hydrodeoxygenation (HDO) and hydrodenitrogenation (HDN) is important for the processing of renewable feedstocks to fuels. In this thesis, the hydrotreatment of fatty amides and their derivatives was studied on supported noble metal catalysts. Competitive HDO and HDN reactions in the reaction network were studied by co-hydrotreating palmitic acid and 1-tetradecylamine over Pt/ZrO_2. HDO proceeded more efficiently than HDN regardless of the feed composition. The preferential HDO of the oxygen-containing compounds and formation of secondary amides and amines via condensation reactions inhibited the HDN of 1-tetradecylamine in the co-hydrotreating experiments. The hydrotreatment of *n*-hexadecanamide was studied over Pt catalysts supported on various inorganic oxides, different active metals supported on ZrO_2, and bimetallic catalysts supported on CeO_2-ZrO_2. The Lewis acid properties of the support influenced the activity and selectivity for the initial *n*-hexadecanamide conversion route, and the conversion of the oxygen-containing intermediate products. Meanwhile, the active metal influenced the activity and selectivity for condensation reactions and for the formation of *n*-paraffins from the intermediate products. HDO proceeded more efficiently than HDN on the studied catalysts. The combination of Ni with a noble metal was particularly beneficial for the catalytic activity, and the RuNi/CeO_2-ZrO_2 catalyst exhibited the highest activity and selectivity towards the formation of *n*-pentadecane out of the studied catalysts. The results of this thesis brought new insights into the influence of the catalyst composition on the activity, selectivity and reaction network in the hydrotreatment of fatty amides to *n*-paraffins.
Field of the doctoral thesis	Chemical Engineering
Doctoral candidate and contact information	M.Sc. (Tech.) Emma Verkama emma.verkama@aalto.fi
Public defence date and time	17 May 2024 at 12 o'clock (in Finnish time)
Remote defence	https://aalto.zoom.us/j/61402681293
Place of public defence	Aalto University School of Chemical Engineering, Lecture hall Ke2 (Komppa-Sali), Kemistintie 1, (main door at Biologinkuja) Espoo
Opponent(s)	Professor Justin Hargreaves, University of Glasgow, United Kingdom
Custos	Professor Riikka Puurunen, Aalto University School of Chemical Engineering
Link to electronic thesis	https://aaltodoc.aalto.fi/handle/123456789/51
Keywords	hydrotreatment, hydrodeoxygenation, hydrodenitrogenation, amide, noble metal catalyst

Dissertation will be on public display at https://aaltodoc.aalto.fi/doc_public/eonly/riiputus/