Catalytic Performance of Zeolite-Supported Vanadia in the Aerobic Oxidation of 5-hydroxymethylfurfural to 2,5-diformylfuran

The catalytic performance of zeolite-supported vanadia catalysts was examined for the aerobic oxidation of 5-hydroxymethylfurfural (HMF) to 2,5-diformylfuran (DFF) in organic solvents such as N,N-dimethylformamide (DMF), methyl isobutyl ketone, toluene, trifluorotoluene and DMSO. Catalysts based on the four different zeolite supports H-beta, H-Y, H-mordenite, and H-ZSM-5 with 1–10 wt% vanadia loading were prepared and characterized by nitrogen physisorption, X-ray powder diffraction, scanning electron microscopy, ammonia temperature-programmed desorption, Raman spectroscopy and UV/Vis spectrophotometry. The H-beta zeolite catalysts were found to contain highly dispersed vanadium oxide species at all loadings, and provided the highest reaction selectivity towards DFF and the lowest metal leaching of the examined systems. In particular, 1 wt % V₂O₅/H-beta was found to be a stable, recyclable, and non-leaching catalyst for the production of DFF under mild conditions in DMF as solvent, although with low DFF yield. To increase the yield, oxidation of HMF at elevated pressures was also investigated with this catalyst. Under optimized conditions, a reaction selectivity towards DFF of >99 % at 84 % HMF conversion was obtained, albeit with some contribution from lixiviated species to the total catalyst activity.

General information
State: Published
Organisations: Department of Chemistry, Centre for Catalysis and Sustainable Chemistry
Pages: 284-293
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: ChemCatChem
Volume: 5
Issue number: 1
ISSN (Print): 1867-3880
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.47 SJR 1.695 SNIP 0.925
Web of Science (2017): Impact factor 4.674
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.33 SJR 1.679 SNIP 0.952
Web of Science (2016): Impact factor 4.803
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 4.57 SJR 1.731 SNIP 0.996
Web of Science (2015): Impact factor 4.724
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 4.52 SJR 1.89 SNIP 1.103
Web of Science (2014): Impact factor 4.556
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 4.82 SJR 2.182 SNIP 1.057
Web of Science (2013): Impact factor 5.044
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Scopus rating (2012): CiteScore 4.58 SJR 2.394 SNIP 1.141
Web of Science (2012): Impact factor 5.181
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes