Influence of preparation method on supported Cu-Ni alloys and their catalytic properties in high pressure CO hydrogenation

Silica supported Cu-Ni (20 wt% Cu + Ni on silica, molar ratio of Cu/Ni = 2) alloys are prepared via impregnation, coprecipitation, and deposition-coprecipitation methods. The approach to co-precipitate the SiO2 from Na2SiO3 together with metal precursors is found to be an efficient way to prepare high surface area silica supported catalysts (BET surface area up to 322 m2 g-1, and metal area calculated from X-ray diffraction particle size up to 29 m2 g-1). The formation of bimetallic Cu-Ni alloy nanoparticles has been studied during reduction using in situ X-ray diffraction. Compared to impregnation, the coprecipitation and deposition-coprecipitation methods are more efficient for preparation of small and homogeneous Cu-Ni alloy nanoparticles. In order to examine the stability of Cu-Ni alloys in high pressure synthesis gas conversion, they have been tested for high pressure CO hydrogenation (50 bar CO and 50 bar H2). These alloy catalysts are highly selective (more than 99 mol%) and active for methanol synthesis; however, loss of Ni caused by nickel carbonyl formation is found to be a serious issue. The Ni carbonyl formation should be considered, if Ni-containing catalysts (even in alloyed form) are used under conditions with high partial pressure of CO. This journal is © The Royal Society of Chemistry.

General information

State: Published
Organisations: Department of Chemical and Biochemical Engineering, CHEC Research Centre, Center for Electron Nanoscopy, Department of Wind Energy, Materials science and characterization, Department of Physics, Experimental Surface and Nanomaterials Physics, Technical University of Denmark, Haldor Topsoe AS, Karlsruhe Institute of Technology
Pages: 378-386
Publication date: 2014
Peer-reviewed: Yes

Publication information

Journal: Catalysis Science & Technology
Volume: 4
Issue number: 2
ISSN (Print): 2044-4753
Ratings:
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 5.47 SJR 1.797 SNIP 1.149
Web of Science (2017): Impact factor 5.365
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 5.64 SJR 1.811 SNIP 1.287
Web of Science (2016): Impact factor 5.773
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 5.46 SJR 1.804 SNIP 1.314
Web of Science (2015): Impact factor 5.287
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 5.44 SJR 1.885 SNIP 1.47
Web of Science (2014): Impact factor 5.426
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 4.89 SJR 1.744 SNIP 1.296
Web of Science (2013): Impact factor 4.76
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes