MgO$_x$-Al$_2$O$_3$ supported Au nanoparticles as Active Catalysts for Selective Hydrogenation of Acetylene

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Here, based on an impregnation-calcination strategy, a series of MgO$_x$-Al$_2$O$_3$ mixed oxides supports with different crystal phases were prepared via a modified deposition-precipitation process for selective hydrogenation of acetylene. The Au/3% MgO$_x$-Al$_2$O$_3$-550 catalyst showed excellent conversion of acetylene at high temperature when compared with Au/Al$_2$O$_3$ catalyst. The better activity was reasonably concluded to small gold particle size and suitable Lewis acidity, originating from the interaction between metal and support in this sample. Moreover, the partially positive charged Au$_{\delta^+}$ species probably play a crucial role in enhancement of acetylene conversion by facilitating the adsorption of the C≡C group, as determined by H$_2$-TPR and XPS analysis.

Figure 1. XRD diffraction patterns of (a) Au/Al$_2$O$_3$ and (b,c,d) Au/3% MgO$_x$-Al$_2$O$_3$/Y catalysts. Y represent the various calcination temperature for 3% MgO$_x$-Al$_2$O$_3$ mixed oxide: (b) 550°C (c) 700°C (d) 900°C ((▲)- MgAl$_2$O$_4$ spinel (△)magnesium oxide, (○)γ-Al$_2$O$_3$).

Figure 2. Plots of the initial hydrogenation activity versus reaction temperature over (a) Au/3% MgO$_x$-Al$_2$O$_3$/Y catalysts with various y value of: 550, 700 and 900°C and Au/Al$_2$O$_3$ (b) bar plot for the catalysts based on the reaction rates measured at 250°C.

References

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