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The effect of copper and silver on the properties of Au-ZnO catalyst and its activity in glycerol oxidation

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Abstract

The goal of this work was to use ZnO as a support for gold and copper (Au-Cu system) or gold and silver (Au-Ag system) and comparison of the effect of copper and silver on the properties of gold and its activity in glycerol oxidation with oxygen in the liquid phase. The samples prepared were fully characterized by XRD, TEM techniques and UV-Vis, XPS, ESR spectroscopic methods. It was found that the introduction of copper and silver changed the electronic state of gold loaded on ZnO by the electron transfer between metals. Three different metallic gold species were identified in calcined catalysts: $(Au^0)^{\delta-}$ (Au-ZnO), $(Au^0)^{\eta-}$ (AuCu-ZnO) and $(Au^0)^{\gamma-}$ (AuAg-ZnO), where $\delta^-, \eta^-, \gamma^-$ indicate a different partial negative charge on metallic gold and $\gamma > \delta > \eta$. The results showed that $(Au^0)^{\eta-}$ centers (metallic gold with the lowest negative charge) formed on AuCu-ZnO were the most active in glycerol oxidation. The increase in the negative charge on metallic gold loaded on AuAg-ZnO reduced the gold activity in silver containing sample. The glyceric acid adsorption and desorption rate influenced the selectivity of the catalysts.

Keywords: ZnO, AuCu and AuAg systems; interactions between metals; glycerol oxidation

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