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Synthesis and Characterisation of Titania supported Gold nanoclusters for Catalysts via Magnetron Sputtering

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Abstract content
 (Max 300 words)

Titania (TiO₂) supported gold nano-clusters have potential commercial application as low temperature CO oxidation catalysts. Au/TiO₂ are highly active for low temperature CO oxidation, however these catalysts deactivate with time on-stream and during storage [1]. It has recently been reported that TiO₂ support hydroxylation results in catalysts with smaller, more structurally stable gold nano-particles and activities between 36 – 180 fold higher than their un-hydroxylated counterparts [2].

Here we report on the investigation of titania supported gold catalysts prepared by magnetron sputtering. In an effort to understand the effect of surface acidity on the activity and stability of gold catalysts, the TiO₂ supports were treated at different pHs prior to catalyst preparation. Au nanoparticles were loaded on the supports by Physical Vapour Deposition (PVD) technique. Two series of catalysts were prepared under argon and oxygen rich atmospheres. Catalyst testing was conducted under dry conditions using 1% CO, 6%O₂ balanced N₂ at 60 SCCM flow rate and 80 mg of catalyst. A variety of characterisations were performed using TEM, DRIFTS, XPS and catalytic activity was measured.

TEM results show no significant particle size difference in catalysts prepared under either Ar or O₂ atmospheres. XPS reveals increased presence of oxidic gold species when the latter is used. DRIFTS qualitatively confirm an increase in the basicity of the catalyst surface with treatment at increasing pH. This is evidenced by the increase in the formation of bidentate carbonate species which involves strong O₂- basic sites [3].

In terms of low temperature CO oxidation the catalysts prepared from TiO₂ supports treated with HNO₃ (pH 3) were found to be inactive. However, activity and stability was found to increase with increased pH of the support treatment, which correlates with an increase in surface hydroxyls.

References

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Primary author: Dr HARRIS, Richard (Mintek)

Co-authors: Dr VEITH, Gabriel (Oak Ridge National Laboratories); Dr MCPHERSON, Jason (Mintek); Ms MOKOENA, L. (Mintek); Dr RAPHULU, M. (Mintek)

Presenter: Dr HARRIS, Richard (Mintek)

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