Gold catalysts supported on mixed oxides highly efficient and stable in the Water Gas Shift reaction

CSIC, in collaboration with the University of Seville, has developed the synthesis of gold catalysts highly efficient in the Water Gas Shift Reaction (WGS). The catalysts, based on gold supported on $CuO/ZnO/Al_2O_3$ mixed oxides with hydrotalcite structure, are able to work without any pre-treatment and are robust against changes in the reaction operation conditions, that make them very useful for production and/or H2 purification processes for fuel processors coupled to fuel cells.

An offer for Patent Licensing

Maximum efficiency of conversion of CO in H_2

The Water Gas Shift reaction, WGS, is a reversible and exothermic process which requires a continuing search for catalytic systems operating at low temperatures which enable increase the amount of hydrogen by decreasing the CO concentration.

Another matter to be considered is that the WGS reactor is usually, by far, the biggest of the integrated process since the reaction is favored at low space velocities. It is because of, to facilitate its implementation in mobile applications, reducing the reactor volume is a key factor. In this regard, the development of catalysts enable of carrying out the reaction at high space velocities is one of the greatest current challenges.

The nowadays catalysts for the WGS reaction at low temperature are based on Cu-Zn mixed oxides. However, they have important drawbacks as their pyrophoricity, pre-treatment activation and, in many cases, deactivation by sintering of the metal particles.

Alternatively it has been proposed the use of catalysts based on noble metals (primarily Au and Pt). However, the highest effectiveness of these catalysts is only achieved with a high load of metal and it makes that, together with its high price, the use of these catalytic systems is limited. Both systems, based on mixed oxides and supported gold, has been intensively studied by separately however there is no reference regarding the use of a combined system.

With all these precedents, gold catalysts supported on $CuO/ZnO/Al_2O_3$ mixed oxides, as alternative regarding the requirements needed for their use in portable devices of energy production, have been developed.

The use of the gold catalysts supported on mixed oxides, represents a significant improvement for both the production and purification of hydrogen through the water gas shift reaction

Main innovations and advantages

- The synthesis and application of gold catalysts supported on $CuO/ZnO/Al_2O_3$ mixed oxides are proposed for their use in the WGS reaction.
- The catalyst synthesis, using a defined hydrotalcite-type structure as a precursor, is carried out in an extremely controlled way. It enables that solids present a significant stability against sintering reflected in a constant and lasting catalytic activity.
- The contribution of a minimum amount of gold results in a maximum (the maximum allowed by thermodynamics in the window temperature 140-250°C) increased catalyst activity.
- Additionally the catalyst presents other advantages such as no pre-treatment step is required, higher resistance towards deactivation, increased durability and higher stability against changes in the reaction operation conditions and start/stop cycles.

Patent Status

Patent granted in Spain and filed in Europe and US.

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