NOVEL 3D-POLYMERIC MONOLITHIC CATALYST

TECNOLOGÍA PATENTADA

DATOS DE CONTACTO:

Research Results Transfer Office-OTRI
University of Alicante
Tel.: +34 96 590 99 59
Email: areaempresas@ua.es
http://innoua.ua.es

RESUMEN

Researchers from Inorganic Chemistry Department at the University of Alicante have developed a new procedure to obtain heterogeneous monolithic catalysts with polymeric support that allow to accelerate catalytic reactions in an optimal way at moderate temperatures, being especially suitable in Preferential Oxidation of Carbon in Hydrogen Rich Gases (CO-PROX). These novel catalysts have been manufactured by 3D printing with complex geometries, improving the performance of current supports. These heterogeneous catalysts are characterized because they have similar conversion and selectivity profiles to current unsupported powder catalysts. They have increased catalytic activity during prolonged reaction times and greater resistance to friction wear. We are looking for companies interested in acquiring this technology for commercial exploitation.

VENTAJAS Y ASPECTOS INNOVADORES

The main advantages of this novel polymeric catalyst are listed below:

1) The presence of slits with prismatic geometry in the channels of the polymeric monolith facilitates the homogeneous distribution of the active phase.

2) The homogeneity of the coating inside the channels prevents excess active phase in some and deficit in others, thus ensuring catalytic efficiency of the catalyst.

3) It presents conversion and selectivity profiles similar to the current powder catalysts without supporting.

4) It has been shown to have great catalytic activity for prolonged reaction times and, therefore, it is more robust than powder catalysts.

5) It is more resistant to friction wear than current catalysts.

6) It has low pressure drops.

7) It has really great heat and mass transfer characteristics.

INNOVATIVE ASPECTS OF THE TECHNOLOGY

In recent years, packaged bed reactors and pellets used in the area of heterogeneous catalysis have been progressively replaced by cellular geometry monoliths. These monoliths exhibit great heat and mass transfer characteristics, low pressure drops, they are easily manipulated for installation and replacement, and they do not generate preferred paths in the fluid.

Commonly, monoliths are manufactured by extrusion, which it limits their geometry to straight and parallel channels. However, using 3D printing it is possible to design and manufacture monolithic supports with complex geometries that allow to improve the performance of the current supports at present.

Polymeric resin monoliths have been designed and manufactured by 3D printing for using as catalyst supports (see Figure 4), obtaining very satisfactory results and being pioneers in the use of polymers as monolithic supports in heterogeneous catalysis.



Figure 4: example of monoliths manufactured by 3D printing and detail of two channels obtained by SEM microscopy (right).

The current procedures to incorporate active phases in monoliths manufactured in non-polymeric materials (for example, cordierite or silicon carbide), are not applicable to polymeric resins due to the bad adherence of the catalyst to the support. However, following the procedure described in the present invention, a homogeneous coating of the monolith channels is obtained with an adequate distribution of the active phases.

In this procedure, it is not necessary to carry out previous attacks on the resin, and a single impregnation step is sufficient to cover homogeneously the surface of the monolith channels.

Another key aspect of this novel procedure is to carry out a heat treatment in an inert atmosphere after impregnation, as well as an additional heat treatment in an oxidising atmosphere. In this way, a strong anchorage of the powder catalyst to the channels of the monolith is achieved.

In addition, after several experimental studies, it can be concluded that modifying the composition of the resin by adding carbon and/or silica charges, modifying the design of the channels from smooth to slits, and increasing the number of impregnation stages, it increases the percentage by weight of the active phase in the catalyst.

APLICACIONES DE LA OFERTA

The present invention is framed in the field of **heterogeneous catalysis**, that is, in those reactions that take place when the catalyst is in a phase (solid, liquid or gas) different from the reagents.

This novel polymeric catalyst can be used in those **catalytic applications** that occur at a temperature lower than the degradation of the polymer, i.e. **below 300ºC**, for example, in Preferential **Oxidation of Carbon Monoxide (CO) in Hydrogen (H_2)** Rich Gases (CO-PROX).

Henceforth, this technology finds its application in the following industrial sectors:

→ Chemical sector.

→ Energy Sector.

COLABORACIÓN BUSCADA

We are looking for companies interested in acquiring this technology for commercial exploitation through:

- Patent licensing agreements.
- Development of new applications.