

fibrous boehmite-alumina slurry. The alumina honeycomb is then removed from the slurry and the excess dried. The coated honeycomb is then dried and further calcined at about 500° C. The dipping process is repeated as necessary until the desired thickness of the coating is obtained.

The alumina honeycomb originally exhibited a surface area from 0.05 to 0.4 square meter per gram. After the above treatment, the coated ceramic honeycomb exhibits a specific surface area of 10 or more square meters per gram.

Instead of the Alcoa F-1 alumina used above, Alcoa C-333 alumina hydrate could be used. This alumina is a commercially available alumina trihydrate having the chemical formula $Al_2O_3 \cdot 3H_2O$ and having an average particle size of 8 microns and 95 to 97% of the particles of less than 44 microns in size.

In another experiment, 2% by solid weight of finely divided platinum diamino dinitrite is added to the fibrous boehmite-alumina slurry. The alumina honeycomb is coated with this slurry, calcined and reduced. The resulting catalytic structure is useful for the oxidation of hydrocarbon fumes and reduction of nitrogen oxides in gas streams.

EXAMPLE 2

A sample of microcrystalline boehmite prepared according to the procedures of U.S. Pat. 3,245,919 is ball milled for three days with water adjusted to pH 3.8 with nitric acid. A paste of 12.6 percent by weight of colloidal boehmite results. The colloidal boehmite is characterized by X-ray analysis showing boehmite and also by the stability of a sol prepared by diluting a portion of the paste with 10 parts by weight of water adjusted to pH 4.0.

A 200 g. sample of -325 mesh Reynolds Metals Company RA-1 activated alumina is suspended in 200 ml. of water and adjusted to pH 4.1 with a few drops of nitric acid. This resulting suspension is mixed with 103 g. of the boehmite paste.

Several alumina and mullite honeycombs were coated with the mixture by dipping; the coated honeycombs are then dried and calcined for two hours at 460° C. The coatings range from 8 percent to 26 percent by weight of the weight of the honeycomb. The surface area of the coating, as measured by nitrogen adsorption, is 218 $m^2/g.$

A solution of platinum tetramine dinitrite adjusted to pH 10 with ammonium hydroxide is prepared to contain 1 percent platinum. The coated honeycomb is dipped into this solution, removed, dried, calcined for 30 minutes at 300° C. and reduced. X-ray analysis shows that a very finely divided platinum metal is deposited on the active alumina coating. This product shows good catalytic activity in oxidizing heptane in air at 300° C.

EXAMPLE 3

A platinum solution is prepared by adding concentrated nitric acid to chloroplatinic acid and evaporating to dryness on a hot plate. This step is repeated three times and the product is dissolved in water to yield a 10% platinum solution. The pH of this solution is adjusted to pH 3.2 with nitric acid.

The platinum solution is added to a coating solution, prepared as in Example 2, to give 2.5% platinum based on the total solids in the composition.

Samples of ceramic pellets and rods are treated by dipping them in the composition, drying and calcining at 400° C. The coated samples turn uniformly gray after several minutes in a gas-rich flame and show good catalytic activity in continuing to catalyze oxidation of the gas mixture when the flame is blown out.

Samples of ceramic honeycomb are coated in a similar manner and reduced in the gas-rich flame. These averaged 10% coating pick-up based on honeycomb weight and show an excellent activity in hydrocarbon oxidation with both air and nitrogen oxides.

EXAMPLE 4

A sample of boehmite prepared according to U.S. Pat. 3,268,295 is prepared as a 13.4 percent paste by the procedure of Example 2.

The paste is used to prepare a coating composition with Alcoa F-1 active alumina. The composition is coated on a ceramic honeycomb and after calcining, the coating is impregnated with cobalt, nickel, and palladium nitrate solutions, respectively.

Other ceramic honeycomb samples are coated after adding about 5 percent of these metals, as nitrates, to the coating composition.

All of the samples are calcined and then hydrogen reduced at 250° C. They all show good catalytic activity in shaker-tube hydrogenations of organic nitriles to amines.

EXAMPLE 5

An alumina honeycomb is coated with a fibrous boehmite-alumina slurry as set forth in Example 1.

An aqueous solution of chloroplatinic acid is prepared equivalent to 1% platinum. The alumina honeycomb is immersed in the chloroplatinic acid solution until it is completely wet. It is thereafter drained and then is placed in a closed, heated vessel, except for gas inlet at one end and outlet at the other which permit hydrogen to be passed over the coated and platinum-impregnated honeycomb. Humidified hydrogen is passed through the vessel and over the coated and impregnated honeycomb at temperatures ranging from 70° C. to a final temperature of 250° C. The hydrogen is humidified by bubbling it through water at 70° C. The platinum is thereby reduced and activated. A catalyst so prepared is effective in oxidation reactions such as the oxidation of carbon monoxide to carbon dioxide, hydrogen to water, and for the reduction of nitrogen oxides with appropriate reducing gases to produce hydrocyanic acid or to produce complete combustion and to produce harmless and deodorized gases. Furthermore, it can be used for hydrogenations such as the hydrogenation of acetylene to ethylene in the presence of excess ethylene. Additionally, it can be used for hydrogenations of benzene to cyclohexane or nitriles such as adiponitrile to hexamethylenediamine or aldehydes such as butyraldehyde to butyl alcohol.

Instead of the platinum specified above, there can be used an equal weight of palladium or a 50:50 mixture of platinum and palladium or rhodium and palladium or rhodium and platinum or ruthenium or ruthenium and rhodium. These catalysts also have activity for those reactions enumerated.

What is claimed is:

1. A process for applying uniform, high surface area active alumina coatings to catalyst supports comprising preparing an aqueous composition consisting essentially of colloidal boehmite with finely divided, high surface area alumina particles having a particle size ranging from 8 to 60 microns and a surface area which ranges from 50 $m^2/g.$ to 600 $m^2/g.$, applying such composition to the catalyst support and heating to temperatures of about 400° C. to 500° C. to obtain a dry coating of 5 to 10% by weight colloidal boehmite and 90 to 95% by weight of active alumina particles.

2. A process for making a supported catalyst comprising preparing an aqueous composition consisting essentially of colloidal boehmite with finely divided, high surface area alumina particles having a particle size ranging from 8 to 60 microns and a surface area which ranges from 50 $m^2/g.$ to 600 $m^2/g.$, applying such composition to the catalyst support and heating to temperatures of about 400° C. to 500° C. to obtain a dry coating of 5 to 10% by weight colloidal boehmite and 90 to 95% by weight of active alumina particles, and subsequently impregnating the dry coating with a catalytic material selected from the group consisting of the oxides, cerates, chromates, chromites, manganates, manganites, molyb-