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CATALYST FOR USE IN THE OXIDATION OF AMMONIA

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The present invention relates to improvements in the oxidation of ammonia and catalysts therefor. It is known that platinum or platinum alloys, particularly alloys of platinum with other metals of the platinum group, may be employed as catalysts in the oxidation of ammonia.

The platinum-rhodium alloys which have been employed give good yields of nitrogen oxides with but small losses of platinum, but as such alloys react only at high temperatures it is necessary to heat the contact bodies or to preheat the contact gases.

A further disadvantage of the platinum-rhodium catalyst is that the rhodium contained therein tends to oxidise at high temperatures, causing a reduction in the efficiency of the catalyst.

The platinum-iridium alloys which have been employed react more vigorously than the platinum-rhodium alloys and at a relatively low temperature. However, these alloys are disadvantageous in that they may cause the reaction to go too far, thereby forming elemental nitrogen with a reduction in yields. Furthermore, when platinum-iridium alloys are employed the loss of platinum is greater than when other platinum alloys are employed.

Contact bodies of pure platinum have been employed only to a small extent, as their catalytic action is comparatively low.

In accordance with the present invention, catalysts consisting of a combination of different contact bodies are employed. The catalyst may be composed, for example, of two or more different alloys, for example platinum-rhodium and platinum-iridium and pure platinum. In general it has been found to be advantageous for the individual components of the contact bodies to be in intimate contact with one another. Wire networks, wire gauze or wire fabrics, such as are employed as catalysts in the synthesis of ammonia, may be made, for example, of wires consisting of platinum alloys and of pure platinum. In this case the procedure may advantageously be such that the various wires are brought into intimate contact by interweaving or intertwisting them or by similar measures. A plurality of wire networks can be united, for example by sewing them together, to form a contact body. The wire networks which are united in this way can be of the same kind or of different kinds and may be composed of the same or of different materials.

It has been found that, because of the action upon one another of the bodies united in this way, it is possible to influence the properties of the individual components and to harmonize them in such a way that the disadvantages of one or the other of the components are eliminated or are reduced to a greater or less extent and advantageous combination effects are produced.

Thus, for example, a sluggish alloy which only reacts at an elevated temperature, for example a platinum-rhodium alloy containing about 10–50% of rhodium, can be combined with a more active alloy which reacts at a lower temperature, for example a platinum-iridium alloy containing about 1–10% of iridium and substantially pure platinum. It is possible in this way to make contact bodies which, as distinguished from platinum-rhodium contact bodies, work at relatively low temperatures, so that on the one hand preheating of the gases may be dispensed with or less preheating may be employed, while on the other hand the disadvantages of platinum-iridium contact bodies such as their vigorous reaction power and their considerable loss of platinum are obviated to a large extent and which have substantially better mechanical properties. Combinations of platinum alloys rich in rhodium, for example alloys which contain 30–50% and preferably about 40% of rhodium, with platinum alloys which contain only a small percentage of iridium, for example those which contain about 1–5% and preferably about 2% of iridium and substantially pure platinum, have proved particularly suitable.

The substantially pure platinum, for example platinum in which the content of rhodium amounts to not more than about 0.1% considerably improves the mechanical properties of the catalyst and also considerably prolongs the life of the catalyst. Thus net-like structures which contain a skeleton of pure platinum wire can be made. Preferably, the wires of pure platinum are interwoven or interlaced with the wires of the platinum alloys.

When building-up the contact bodies, it is advantageous to combine wires or the like of different thicknesses with one another. Thus, for example, wires of the more easily volatile platinum-iridium alloys are made thicker in accordance with the greater extent to which they are used up than those of the less volatile alloys, for example platinum-rhodium alloys.

The alloys to be employed in accordance with the present invention may in some cases contain, in addition to platinum, more than one other metal of the platinum group.

In accordance with the invention the disadvantages which were associated with the various

known contact substances, such as the necessity of an additional supply of heat, high working temperatures, poor yields, loss of platinum and an increase in brittleness may be obviated to a large extent. With the contact bodies which are manufactured in accordance with the invention high yields may be obtained at relatively low temperatures. Such contact bodies also have a very long life.

Example

A wire consisting of at least 99.9% of platinum and having a diameter of 0.08 mm. is woven alternately with 5 to 10 wires of alternately woven platinum-rhodium wires containing 10% of rhodium and platinum-iridium wires containing 1% of iridium, respectively having a diameter of 0.06 mm. and a diameter of 0.075 mm. so as to form a network having 1020 meshes per square centimetre. Five layers of such network are intimately combined to form a contact body by sewing them together.

A contact body of this nature has a life two to three times longer than that of an ordinary platinum contact body.

I claim:

1. In a process for the oxidation of ammonia, the step comprising passing a reaction mixture containing ammonia through a catalyst comprising a network which consists of wires of platinum-rhodium alloy, platinum-iridium alloy and pure platinum, respectively, which wires are interwoven with each other so as to be in intimate contact with each other, without supplying external heat.

2. A catalyst for the oxidation of ammonia, comprising a network which consists of wires of platinum-rhodium alloy, platinum-iridium alloy and pure platinum, respectively, which wires are interwoven with each other so as to be in intimate contact with each other.

3. A catalyst according to claim 2 in which the wires of pure platinum contain at least 99.9% platinum.

4. A catalyst according to claim 2 in which said platinum-iridium alloy wires are thicker than the platinum-rhodium alloy wires.

5. A catalyst according to claim 2 in which the network contains a skeleton of pure platinum wires which carries the platinum-rhodium wires and the platinum-iridium wires which are interwoven therewith so as to be in intimate contact with each other.

6. A catalyst according to claim 2 in which the platinum-rhodium wires contain 10% to 50% of rhodium and the platinum-iridium wires contain 1% to 10% of iridium.

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