~~As originally filed~~

Reactor for carrying out an exothermic reaction in the gas phase

Description

The invention proceeds from a reactor for carrying out an exothermic reaction in the gas phase, which comprises a vessel having an outer wall composed of a metallic material.

Reactors of this type are used, for example, in the case of reactions which are carried out at elevated temperatures. Here, the material of which the reactor is made has to be selected so that it is stable at the temperatures which prevail in the interior of the reactor. Particularly in the case of corrosive media, there is the additional problem that the material is attacked by the media used and additional weakening occurs as a result of the high temperatures at which the reaction is carried out. In particular, it has to be taken into account that the outer wall of the reactor is generally a load-bearing part on which the mass of the reactor additionally rests.

A reaction which is carried out at elevated temperature using corrosive media is, for example, the oxidation of sulfur dioxide to sulfur trioxide.

The reactors used at present for this oxidation are usually made of stainless steel. However, it has been found that the material is damaged due to the temperatures occurring during the oxidation, which leads to a reduction in the creep strength and thus also to a reduced life of the reactor. Thus, for example, the stainless steels having the material numbers 1.4878 or 1.4541 which are generally used are subject to creep damage at temperatures above 560°C. The damage results from a change in the mechanical materials properties which, depending on the progress of the damage, can lead to failure.

It is therefore an object of the ~~present invention~~embodiments disclosed herein to provide a reactor which, compared to the reactors known from the prior art, has an increased operating life when carrying out an exothermic reaction in the gas phase or permits higher gas-phase temperatures.

This object is achieved by a reactor for carrying out an exothermic reaction in the gas phase, which comprises a vessel having an outer wall composed of a metallic material, wherein an inner shell is accommodated in the interior of the reactor and the inner shell has a spacing of at least 50 mm to the inside of the outer wall.

In a first aspect, there is provided a reactor for carrying out an exothermic reaction in the gas phase, which comprises a vessel having an outer wall composed of a metallic material, wherein an inner shell is accommodated in the interior of the reactor and the inner shell has a spacing of at least 50 mm to the inside of the outer wall and wherein there is a gap between the inner shell and the bottom and/or lid of the reactor, the gap between the inner shell and the bottom and/or lid being kept so small that a pressure equalization occurs but only a small gas flow through the gap between the inner shell and the outer wall is generated.

In a second aspect, there is provided the use of the reactor as defined above for carrying out an exothermic reaction in the gas phase, wherein the reaction is carried out at a temperature above 300°C.

In a third aspect, there is provided the use of the reactor as defined above for carrying out a reaction of sulfur dioxide with oxygen to form SO_3.

~~as enclosed to IPRP~~

Claims

1. A reactor for carrying out an exothermic reaction in the gas phase, which comprises a vessel having an outer wall ~~(13)~~ composed of a metallic material, wherein an inner shell ~~(17)~~ is accommodated in the interior of the reactor ~~(1)~~ and the inner shell ~~(17)~~ has a spacing of at least 50 mm to the inside of the outer wall ~~(13)~~ and wherein there is a gap ~~(19)~~ between the inner shell ~~(17)~~ and the bottom and/or lid of the reactor ~~(1)~~, the gap between the inner shell ~~(17)~~ and the bottom and/or lid being kept so small that a pressure equalization occurs but only a small gas flow through the gap between the inner shell ~~(17)~~ and the outer wall ~~(13)~~ is generated.

2. The reactor according to claim 1, wherein the inner shell ~~(17)~~ is made of the same material as the outer wall ~~(13)~~.

3. The reactor according to claim 1 or 2, wherein at least one tray is accommodated in the reactor ~~(1)~~.

4. The reactor according to any of claims 1 to 3, wherein a catalyst bed ~~(7)~~ is present in the reactor ~~(1)~~.

5. The reactor according to any of claims 1 to 4, wherein the reactor ~~(1)~~ is divided into a plurality of segments ~~(3)~~, with each segment ~~(3)~~ having at least one inlet and at least one outlet and each segment ~~(3)~~ comprising a catalyst bed ~~(7)~~ and a gas space ~~(9)~~ above the catalyst bed.

6. The reactor according to claim 4 or 5, wherein the catalyst bed ~~(7)~~ comprises a heterogeneous catalyst.

7. The reactor according to claim 5 or 6, wherein an intermediate tray ~~(23)~~ is accommodated in the reactor ~~(1)~~ to separate in each case two segments ~~(3)~~.

8. The use of the reactor according to any of claims 1 to 7 for carrying out an exothermic reaction in the gas phase, wherein the reaction is carried out at a temperature above 300°C.

9. The use of the reactor according to any of claims 1 to 7 for carrying out a reaction of sulfur dioxide with oxygen to form SO_3.