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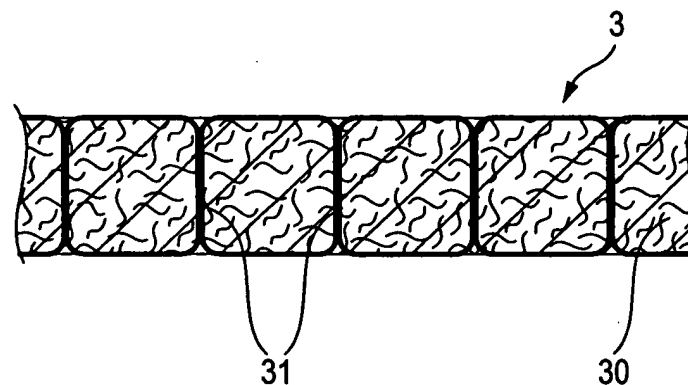
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(54) **Holding Material for Catalytic Converter**

(57) A holding material (3) is provided for a catalytic converter having a catalyst carrier (1), a casing (2) for receiving the catalyst carrier (1). The holding material (3) is interposed in a gap between the catalyst carrier

(1) and the casing (2) while wound on the catalyst carrier (1). The holding material (3) is constituted by a sewn product of a mat material (30) formed by collection of not smaller than 100 cc/5 g by wet volume of inorganic fiber without use of any binder.

FIG. 1



Description

Background of the Invention

Field of the Invention

[0001] The present invention relates to a catalyst carrier holding material used in a catalytic converter, for example, for purging exhaust gas emitted from an automobile.

Description of the Related Art

[0002] As known commonly, a catalytic converter for purging exhaust gas is loaded in a vehicle such as an automobile in order to remove detrimental components such as carbon monoxide, hydrocarbon and nitrogen oxides from exhaust gas emitted from an engine of the vehicle. Generally, as shown in Fig. 2 which is a sectional view, the catalytic converter has a catalyst carrier 1 shaped like a cylinder, a metal casing 2 for receiving the catalyst carrier 1, and a holding material 3 interposed in a gap between the catalyst carrier 1 and the casing 2 while mounted on the catalyst carrier 1.

[0003] Generally, the catalyst carrier 1 has a cylindrical honey-comb molded material, for example, made of cordierite, and a precious metal catalyst carried by the molded material. It is therefore necessary that the holding material 3 interposed in a gap between the catalyst carrier 1 and the casing 2 has a function for holding the catalyst carrier 1 safely to prevent the catalyst carrier 1 from being damaged by collision with the casing 2 due to vibration or the like during the running of the automobile, and a function for sealing the catalyst carrier 1 to prevent non-purged exhaust gas from leaking out through the gap between the catalyst carrier 1 and the casing 2. Therefore, at the present time, there is widely used a so-called mat type holding material which is constituted by inorganic fiber such as alumina fiber, mullite fiber or other ceramic fiber collected into a predetermined thickness while bound with an organic binder to thereby provide adequate elasticity.

[0004] Examples of the organic binder generally used in the holding material 3 include rubber compounds, water-soluble organic high-molecular compounds, thermoplastic resins, and thermosetting resins. It is necessary to make the holding material 3 thin to a certain degree because the holding material 3 can be hardly mounted on the catalyst carrier 1 and hardly attached to the casing 2 if the holding material 3 is too thick. Therefore, the holding material 3 generally used is formed so that the ratio of the amount of the organic binder to the total amount of the holding material is in a range of from 5 % by weight to 10 % by weight or about 12 % by weight at maximum.

[0005] The catalyst carrier 1 has been however recently heated to about 1,000°C in order to improve purging efficiency. For this reason, the organic binder listed

above is decomposed and burned out easily, so that CO₂, CO and various kinds of organic gases are produced. Particularly, a great deal of gas is produced in an early stage of the start of the catalytic converter. Regulation of exhaust emission control has become more and more rigid. There is a possibility that the amount of exhaust gas may be over a regulated value because of CO₂, etc. derived from the organic binder. On the other hand, electronic engine control has been recently developed. The presence of CO₂ having no relation to exhaust gas originally may cause malfunctions of exhaust sensors to exert a bad influence on the electronic engine control. To prevent this drawback, a maker carries out a baking process to burn out the organic binder before shipping. The baking process is a heavy burden imposed on the maker. This is a major issue.

[0006] Reduction in quantity of the organic binder is also conceived. In this case, force of binding the inorganic fiber is however weakened in accordance with the reduction in quality of the organic binder. For this reason, it is necessary to make the holding material 3 thick, so that there is a problem that assembling property is worsened.

Summary of the Invention

[0007] As described above, the related-art holding material has various problems resulting from the organic binder. Therefore, an object of the invention is to provide a holding material for a catalytic converter in which inorganic fiber can be bound well even without use of any organic binder so that the thickness of the holding material can be kept equal to that of a related-art holding material.

[0008] The present inventors have made eager examination to achieve the foregoing object. As a result, it has been found that the thickness of the holding material can be suppressed without use of any organic binder when continuous inorganic fiber is collected into a mat shape and sewn. Thus, the invention is accomplished.

[0009] That is, in order to achieve the foregoing object, the invention provides a holding material for a catalytic converter having a catalyst carrier, a casing for receiving the catalyst carrier, and a holding material interposed in a gap between the catalyst carrier and the casing while wound on the catalyst carrier, the holding material being constituted by a sewn product of a mat material formed by collection of not smaller than 100 cc/5 g by wet volume of inorganic fiber without use of any binder.

[0010] The wet volume is an index for providing a fiber length and is calculated by a method having the following steps:

- (1) weighing 5 g of a dried fiber material by a weigher with accuracy of two or more decimal places;
- (2) putting the weighed fiber material into a glass beaker having a weight of 500 g;

(3) putting about 400 cc of distilled water at a temperature of 20-25°C into the glass beaker prepared in the step (2) and dispersing the fiber material into the distilled water (by an ultrasonic cleaner if necessary) while stirring carefully by a stirrer so that the fiber material is not cut;

(4) transferring the content of the beaker prepared in the step (3) into a 1,000 ml graduated measuring cylinder and adding distilled water into the graduated measuring cylinder up to the scale of 1,000 cc;

(5) ten-times repeating a process of stirring the content of the graduated measuring cylinder prepared in the step (4) by turning the graduated measuring cylinder upside down while blocking an opening of the graduated measuring cylinder with the palm of a hand or the like carefully to prevent water from leaking out;

(6) measuring the sedimentation volume of fiber by eye observation after placing the graduated measuring cylinder quietly under room temperature for 30 minutes after the stop of the stirring; and

(7) applying the aforementioned procedure to three samples and taking an average of the measured values as a measured value.

Brief Description of the Drawings

[0011]

Fig. 1 is a sectional view showing a holding material according to the invention.

Fig. 2 is a sectional view typically showing a catalytic converter.

Detailed Description of the Preferred Embodiments

[0012] A holding material according to the invention will be described below in detail.

[0013] As shown typically in Fig. 1 which is a sectional view, the holding material 3 according to the invention is formed in such a manner that a mat material 30 formed by collection of inorganic fiber without use of any binder is sewn with sewing thread 31.

[0014] The kind of the inorganic fiber for forming the mat material 30 is not limited. For example, alumina fiber, mullite fiber or other ceramic fiber may be used suitably. More specifically, the material preferably used as the alumina fiber is fiber, for example, containing 90 % by weight or more of Al_2O_3 (and SiO_2 as a residual component) and having low crystallinity in terms of X-ray crystallography. The material preferably used as the mullite fiber is a mullite composition, for example, having an $\text{Al}_2\text{O}_3/\text{SiO}_2$ weight ratio of about 72/28 to about 80/20 and having low crystallinity in terms of X-ray crystallography. Examples of the other ceramic fiber may include silica-alumina fiber, and silica fiber. Any known material used in a holding material in the related art may be used as the other ceramic fiber. In addition, glass fiber, rock

wool or biodegradable fiber may be mixed with the inorganic fiber.

[0015] In the invention, there is used continuous fiber selected from these kinds of inorganic fiber and having a wet volume of not smaller than 100 cc/ 5 g, preferably not smaller than 400 cc/5 g. If inorganic fiber having a wet volume smaller than 100 cc/5 g is used, individual fiber pieces are too short to keep both density and thickness at initial values because fiber pieces are apt to drop out through gaps of the sewing thread 31 according to the sewing pitch (the distance between adjacent portions of sewing thread 31) even in the case where sewing is performed. In addition, because fiber pieces are little intertwined with one another, there is a possibility that delamination may occur to reduce both holding performance and sealing performance when the holding material is mounted in the casing. Incidentally, the upper limit of the wet volume is not particularly provided but is generally selected to be in a range of from 400 cc/5 g to 1,000 cc/5 g.

[0016] Metal fiber sewing thread, inorganic fiber sewing thread or organic fiber sewing thread can be used as the sewing thread 31.

[0017] Preferred examples of the sewing thread include SUS fiber sewing thread (such as Naslon sewing thread), alumina fiber sewing thread, mullite fiber sewing thread, silica-alumina fiber sewing thread, silica fiber sewing thread, glass fiber sewing thread, rock wool sewing thread, biodegradable fiber sewing thread, carbon fiber sewing thread, cotton thread, acrylic fiber sewing thread, polyethylene fiber sewing thread, polyethylene terephthalate fiber sewing thread, aramid fiber sewing thread, aromatic polyamide fiber sewing thread, and polyoxybenzole fiber sewing thread. Sewing thread made of a mixture of two kinds of fiber selected from the group consisting of metal fiber, inorganic fiber and organic fiber can be also used preferably. The mixed fiber sewing thread is advantageous to both production aspect and functional aspect because strength of metal fiber, elasticity (spring characteristic) of inorganic fiber and flexibility of organic fiber can be mixed synergically.

[0018] Because the organic fiber sewing thread is decomposed at a high temperature, the same gas as produced from an organic binder used in a related-art holding material is produced from the organic fiber sewing thread. The amount of the organic fiber sewing thread used for sewing is however considerably small compared with the amount of the binder used, so that the gas produced from the organic fiber sewing thread is practically insignificant. Further, although the inorganic fiber also contains a binder, the amount of the binder contained in the inorganic fiber is further smaller. Accordingly, a holding material substantially containing no organic component can be obtained when the holding material is heated after sewing as will be described later. In consideration of the organic component, it may be said that the metal fiber sewing thread is the most preferable.

[0019] The sewing pitch is determined variously in accordance with the length (wet volume) of the inorganic fiber for forming the mat material 30 and the thickness and density of the resulting holding material but is preferably selected to be in a range of from 3 mm to 20 mm. Particularly when the organic fiber sewing thread is used, the amount of the organic fiber sewing thread used increases as the pitch decreases. Accordingly, it is preferable from the point of view of suppressing the organic component that the pitch is selected to be large to a certain degree.

[0020] The holding material 3 according to the invention is produced as follows. First, inorganic fiber is collected without use of any binder to thereby produce a mat material 30 having a predetermined thickness. On this occasion, various kinds of additives (except any binder) as mixed with the related-art holding material may be mixed with the mat material 30. Then, the mat material 30 is compressed into a thickness of the finally produced holding material and sewn while the compressed state is kept by temporal tacking with nonwoven fabric or the like if necessary. Thus, the holding material is obtained. Incidentally, when the mat material 30 is sewn with inorganic fiber sewing thread, it is preferable that the whole of the mat material 30 is heated after sewing to remove the binder contained in the fiber.

[0021] As shown in Fig. 2, the holding material 3 formed in the aforementioned manner according to the invention is wound on the catalyst carrier 1 and interposed between the gap between the catalyst carrier 1 and the casing 2 in the same manner as in the related art.

Example

[0022] The invention will be described below more specifically in connection with the following Example but the invention is not limited thereto at all.

(Production of Holding Material)

[0023] Alumina fiber having a wet volume of 800 cc/5 g was collected without use of any binder to form a mat material 100 mm in width, 314 mm in length, 20 mm in thickness and 1,000 g/m² in grammage (areal density). Then, the mat material was compressed into a thickness of 7.5 mm, temporally tacked with nonwoven fabric and sewn with Naslon sewing thread at intervals of a pitch of 10 mm to obtain a holding material.

(Mount Test)

[0024] The holding material was wound on a cordierite catalyst carrier of a cylindrical honey-comb structure having an outer diameter of 100 mm and a length of 120 mm and then mounted in a stainless steel casing to produce a catalytic converter. The produced catalytic converter was connected to an exhaust pipe of a gasoline

engine. Exhaust gas was passed through the catalytic converter. Gas emitted from the catalytic converter during the passage of the exhaust gas was analyzed. As a result, CO₂, CO and organic gas were not detected even just after the passage of the exhaust gas. In addition, non-purged exhaust gas supposed to be derived from leakage of the holding material was not detected even during the passage of the exhaust gas, so that good sealing performance was obtained.

[0025] As described above, according to the invention, there can be obtained a holding material containing no organic component or containing a very small amount of organic component even in the case where the organic component is contained, so that various problems caused by the related-art holding material using an organic binder can be solved.

Claims

1. A holding material for a catalytic converter, interposed in a gap between a catalyst carrier and a casing receiving the catalyst carrier, comprising:
a mat material formed of not smaller than 100 cc/5 g by wet volume of inorganic fiber without use of any binder and sewn with sewing thread.
2. The holding material according to claim 1, wherein the mat material is sewn at intervals of a sewing pitch of 3 mm to 30 mm.
3. The holding material according to claim 1, wherein the sewing thread is made of one of metal fiber sewing thread, inorganic fiber sewing thread and organic fiber sewing thread.
4. The holding material according to claim 1, wherein the sewing thread is made of at least one member selected from the group consisting of alumina fiber, mullite fiber, silica-alumina fiber, silica fiber, glass fiber, rock wool and biodegradable fiber.
5. The holding material according to claim 1, wherein the sewing thread is made of a mixture of at least two members selected from the group consisting of metal fiber, inorganic fiber, and organic fiber.

FIG. 1

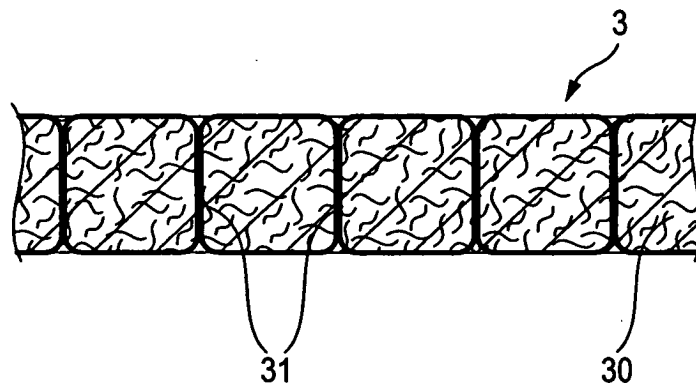


FIG. 2

