A system for producing heat insulation structures for insulating heat generating components

This invention relates a system (100) and a method for producing heat insulation component (505, 600, 700) for insulating heat generating components such as catalytic converter. A moving mechanism moves a forming mould (101, 301) having a permeable moulding surface (302) into pulp containing ceramic fibers. A vacuum source (104, 307) is connected to the forming mould for supplying vacuum to the forming mould so as to draw pulp through the permeable surface side leaving at least one outwardly facing ceramic fiber structure (505) on the outer surface side of the forming mould. A heat mechanism (103) is connected to a pressure mechanism (105) for supplying a pressure and simultaneously heat onto the at least one outwardly facing ceramic fiber structure so as to smoothen and simultaneously drying the at least one outwardly facing fiber structure side.
The present invention relates to a system and a method for producing heat insulation structures for insulating heat generating components.

BACKGROUND OF THE INVENTION

Heat insulating components for providing heat insulation for heat generating components such as catalytic converters play a key role in maintaining the functioning of the catalytic converters, but if the catalytic converters go below a given temperature they lose their functioning. Taking into account the number of vehicles in the world, the number of heat insulating components that must be produced in yearly basis is enormous.

A most common way of producing such heat insulating components is by dipping a forming mould into pulp containing fibers, applying vacuum to the forming mould so as to draw pulp through the permeable surface side leaving at least one outwardly facing ceramic fiber structure on the outer surface side of the forming mould. Finally, the outwardly facing ceramic fiber structure is release from the forming mould and dried in a drying station.

The drawback with this production is how time demanding it is, but this drying step takes typically between 30-40 minutes.

SUMMARY OF THE INVENTION

On the above background it is an object of embodiments of the present invention to provide an improved system and a method for producing heat insulation structures for insulating heat generating components such as catalytic converter so as to reduce the production time.

Embodiments of the invention preferably seeks to mitigate, alleviate or eliminate one or more of the above mentioned disadvantages singly or in any combination. In particular, it may be seen as an object of embodiments of the present invention to provide a system and a method that solves the above mentioned problems, or other problems, of the prior art.

To address one or more of these concerns, in a first aspect of the invention a system is provided for producing heat insulation component for insulating heat generating components, comprising:

- a forming mould comprising a permeable moulding surface,
- a moving mechanism for moving the forming mould into pulp containing ceramic fibers,
- a vacuum source connected to the forming mould for supplying vacuum to the forming mould so as to draw pulp through the permeable surface side leaving at least one outwardly facing ceramic fiber structure on the outer surface side of the forming mould,
- a heat mechanism, and
- a pressure mechanism connected to the heat mechanism for supplying a pressure and simultaneously heat onto the at least one outwardly facing ceramic fiber structure.

Surprisingly, by supplying the pressure and simultaneously heat onto the outwardly facing ceramic fiber structure an almost instant drying, and typically also smoothing, is achieved of the at least one outwardly facing ceramic fiber structure, resulting in the heat insulation component(s). The result is that enormous increase in throughput is achieved, but instead of using 30-40 minutes for drying the ceramic fiber structure resulting in the heat insulation component(s), the production of such insulation component(s) is obtained within few seconds.

Thus, no drying station is needed but such drying stations are typically one of the most expensive components in such systems, but they do not only require much energy, which will in most cases be reflected in higher wholesale price, but are also very spacious.

Accordingly, the system according to the present invention is capable of producing heat insulation component(s) with less production costs compared to prior art systems, which will obviously result in lower wholesale price of the heat insulation component(s).

The heat generating components may as an example be a catalytic converters used in vehicles, but the heat generating components may just as well be any types of components used in e.g. aircrafts, ships, submarines, and any types of machineries.

The pulp containing ceramic fibers may in one embodiment be a mix of 99% water and 1% of ceramic fibers. Other ratios between the water and the ceramic fibers are of course also possible.

In one embodiment, the forming mould is a male or female forming mould. This forming mould may in an embodiment comprise a wire mesh or any type of material such as steel plate or any type of plate alloy having multiple of openings, and the like, that define the shape of the heat insulation component such that after removing the forming mould from the pulp containing the ceramic fibers, the ceramic fiber structure on the outer surface side of the forming mould that is in a wet state has substantially the same shape as the heat insulation component(s). The forming mould may comprise a frame structure with e.g. the above mentioned wire mesh extending between the frame structure. This forming mould may also be considered as being equivalent to a pulp mould.

The pressure mechanism comprises in one embodiment a structure which outer side has a female or male like shape essentially following the shape of the male or female forming mould, wherein supplying the pressure onto the at least one outwardly facing ceramic fiber structure comprises compressing the forming mould having the at least one outwardly facing ceramic fiber structure.
structure and the outer side of the female or male like structure together. As an example, if the forming mould is female forming mould comprising plurality of cavities defining the shape of the heat insulation structures, the outer surface of the structure of the pressure mechanism would have a corresponding male shape structures such that when the blow forming and the structure are compressed together, the male and female structures fit perfectly together. The same applies if the forming mould is male forming mould, then the outer surface of the structure of the pressure mechanism would have a corresponding female structures.

[0015] The structure of the pressure mechanism may in one embodiment be stationary in relation to the forming mould, i.e. the forming mould is the moving component that moves from the pulp to the stationary structure and presses the at least one outwardly facing fiber structure side against the stationary structure.

[0016] In one embodiment, the female or male like structure of the pressure mechanism comprises plurality of openings. The heat mechanism comprises in one embodiment a heat source and a gas compression mechanism connected to the heat source, where the heat source is adapted to heat up compressed gas from the gas compression mechanism or to heat up gas before being compressed by the gas compression mechanism, and where the gas compression mechanism is connected to the female or male like structure of the pressure mechanism comprising the plurality of openings and is adapted to blow pre-heated compressed gas from an inner side of the female or male like structure through the plurality of openings to the outer side of the female or male like structure. Accordingly, an effective way is provided to provide the heat needed, in combination with the pressure, to achieve that above mentioned drying within a second or seconds.

[0017] In one embodiment, the pressure of the compressed gas blown out through the plurality of openings to the outer side of the female or male like structure is between 7-80bar, preferably between 30-70bar, more preferably in the range of 40-60bar, most preferably around 50bar.

[0018] In one embodiment, the temperature of the compressed gas blown out through the plurality of openings to the outer side of the female or male like structure is in the range of 100-400°C, preferably between 200-300°C.

[0019] In one embodiment, the supplied pressure between the forming mould and the pressure mechanism is in the range of 1*10^5Pa-1*10^7Pa, preferably in the range of 5*10^5Pa-5*10^6Pa, more preferably around 1*10^6Pa. An example, the pressure may be around 1.3*10^6Pa.

[0020] Accordingly, using the above mentioned combination of pressure and temperature ranges, e.g. temperature around in the range of 200-300°C, and pressure e.g. around 50bar and pressure around 1*10^6Pa, and optionally a contact time (touching time) while the pulp mould and the female or male like structure are compressed together of 0.5-1.5seconds with the above mentioned pressure, which may be between 0.75-1.25seconds, more preferably around 1second, results in the above mentioned almost instant drying of the at least one outwardly facing ceramic fiber structure, resulting in the heat insulation component(s).

[0021] In one embodiment, the moving mechanism comprises a computer controlled robotic arm that is connected to the vacuum source, the robotic arm being adapted:

- move the forming mould into the pulp containing the ceramic fibers,
- move the forming mould containing ceramic fibers out of the pulp, and
- compress the forming mould containing the ceramic fibers to the pressure mechanism.

[0022] Thus, an efficient and fast way is provided for producing the above mentioned heat insulation component(s). The connection between the forming mould and the vacuum source may occur via the computer controlled robotic arm using suitable conduit(s) and/or pipes extending from the vacuum source e.g. through the computer controlled robotic arm and to the forming mould.

[0023] In one embodiment, the system further comprises a drying station for drying the heat insulation structures subsequent to the step of supplying the pressure and simultaneously heat onto the at least one outwardly facing ceramic fiber structure. Although such drying station is not needed in the system according to the present invention, in some instances it may be an advantage to implement such a drying station for obtaining a final drying step, which is much less (e.g. few minutes instead of 30-40 minutes in prior art systems) due to the fact that most of the drying step has already taken place. However, such a drying station is typically an optional feature in relation the above mentioned system.

[0024] In one embodiment, the heat insulation component has a shape selected from:

- a two dimensional shape and where the heat insulation component is a fiber mat,
- a three dimensional shape having a cylindrical or cylindrical like shape such that the heat insulation component is open at both ends,
- a three dimensional shape having a cylindrical or cylindrical like shape and a bottom portion such that the heat insulation component is open at one end.

[0025] It should be noted that the shape of the heat insulation component should not be construed as being limited to the above mentioned shapes, but all types of shapes may also be produced by the system according to the present invention, e.g. all types of two dimensional shapes such as a mat forming strip, or a rectangular, triangular, rhombuls like strap, or a three dimensional
The length/circumference of the heat insulation hemisphere open at one end etc.

[0026] The length/circumference of the heat insulation component may vary depending on the dimension of the heat generating components, e.g. the mat forming strip may be 50-100cm long (depending on the component to be insulated).

[0027] In an embodiment, the thickness of the heat insulation component may be adapted to the amount of heat to be insulated, e.g. may be from a millimeter or several millimeters to a centimeter or several centimeters.

[0028] Accordingly, it is possible to produce a heat insulation component that is especially suitable for providing a heat insulation for a component such as a catalytic converter, wherein e.g. a cylindrical shaped heat insulation that may easily and effectively be slid onto the catalytic converter, instead of using one or more heat insulation component strips to provide the heat insulation needed so as to allow the catalytic converter to function properly.

[0029] In a second aspect of the invention a method is provided for producing heat insulation structures for insulating heat generating components by the above mentioned system, comprising:

- moving the forming mould into pulp containing ceramic fibers,
- supplying vacuum to the forming mould so as to draw pulp through the permeable surface side leaving at least one outwardly facing ceramic fiber structure on the forming mould,
- supplying a pressure and simultaneously heat by the pressure and heat mechanism onto the at least one outwardly facing ceramic fiber structure.

[0030] In one embodiment, the forming mould is a male or female pulp forming mould and the pressure mechanism comprises a structure which outer side has a female or male like shape essentially following the shape of the male or female forming mould, the step of supplying the pressure and simultaneously heat comprising:

- moving the forming mould with the at least one outwardly facing ceramic fiber structure towards the female or male like structure of the pressure mechanism, and
- compressing the forming mould and the female or male like structure together such that the male and female parts of the forming mould and the structure of the pressure mechanism engage with each other.

[0031] In one embodiment, the female or male like structure of the pressure mechanism comprises plurality of openings, wherein prior to and/or during the compressing of the forming mould and the female or male like structure together, pre-heated compressed gas is injected from an inner side of the female or male like structure through the plurality of openings to the outer side of the female or male like structure. As already discussed, the temperature of the gas, which may be air, may be, but is not limited to, in the range of 100-400°C, preferably between 200-300°C. The temperature may also be selected to be below 100°C or above 400°C. Also, the pressure of the gas may be, but is not limited to, between 7-80bar, preferably between 30-70bar, more preferably in the range of 40-60bar, most preferably around 50bar. The pressure may also be selected to be below 7bar pressure or above 80bar pressure. In instances where e.g. the pressure and the temperature is relative low, such as around 7bar and 100 °C, it may be preferred to utilize additionally a drying station to obtain the final drying step.

[0032] In one embodiment, the forming mould and the female or male like structure are compressed together for 0.5-1.5seconds, preferably between 0.75-1.25seconds, more preferably around 1second. This should not be construed as being limited to these values, but this time may be selected such that the heat insulation structures are fully dry after the compression between the forming mould and the pressure mechanism. This time may also depend on the temperature of the pressure mechanism and/or the pressure between the forming mould and the pressure mechanism when compressed together.

[0033] In a third aspect of the invention a heat insulation structure is provided produced by the above mentioned method for insulating heat generating component. In an embodiment, the heat generating component is, but is not limited to, a catalytic converter

[0034] In general the various aspects of the invention may be combined and coupled in any way possible within the scope of the invention. These and other aspects, features and/or advantages of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035] Embodiments of the invention will be described, by way of example only, with reference to the drawings, in which

Figure 1 shows a system according to the present invention for producing heat insulation component for insulating heat generating components such as catalytic converter,

Figure 2 depicts an embodiment of a pressure mechanism according to the present invention,

Figure 3 shows an embodiment of a structure mould according to the present invention that may be used with the male mould shown in figure 2,

Figure 4 shown an example of where three dimensional heat insulation components are produced using forming mould and a pressing mechanism according to the present invention,

Figure 5 depicts graphically one embodiment of production steps of manufacturing heat insulation components for insulating heat generating components,
Figure 6 shows one example of a two dimensional heat insulation component, Figure 7 shows one example of a three dimensional heat insulation component, and Figure 8 shows where the three dimensional heat insulation component in figure 7 is used to provide a heat insulation for a catalytic converter.

DESCRIPTION OF EMBODIMENTS

[0036] Figure 1 shows a system 100 according to the present invention for producing heat insulation component for insulating heat generating components such as catalytic converter or any types of components of any types of machineries in e.g. vehicles, aircrafts, ships, submarines etc..

[0037] The system comprises a forming mould 101 having a permeable moulding surface (not shown), a moving mechanism 102, which as depicted here comprises a computer controlled robotic arm, for moving the forming mould into and out of a pulp 106 containing ceramic fibers.

[0038] The system further comprises a vacuum source 104 connected to the forming mould for supplying vacuum to the forming mould so as to draw pulp through the permeable moulding surface leaving at least one outwardly facing ceramic fiber structure on the outer surface side of the forming mould 101.

[0039] The vacuum source 104 may be connected to the forming mould 101 via the computer controlled robotic arm 102 where e.g. appropriate vacuum conduit or conduits (not shown) may be arranged from the vacuum source under the floor to the robotic arm. The computer controlled arm may in one exemplary embodiment be provided with one or more male/female openings (e.g. nozzles) that connect to corresponding female/male openings on the forming mould, and where the vacuum is transferred to the forming mould via these openings.

[0040] As will be discussed in more details later, the system 100 further comprises a heat mechanism 103 and a pressure mechanism 105 connected to the heat mechanism 103 for supplying a pressure and simultaneously heat onto the at least one outwardly facing ceramic fiber structure (not shown) so as to smoothen and simultaneously drying the at least one outwardly facing fiber structure side of the forming mould.

[0041] The heat mechanism 103 and the pressure mechanism 105 are depicted here as two separated units that are connected together via appropriate connections such as heat conduct, pipelines, wires and the like. The heat mechanism may just as well be comprised in the pressure mechanism 105 and in a way be an integral part thereof.

[0042] The system 100 shown here may further comprise a drying station 107 for drying the heat insulation structures subsequent to the step of supplying the pressure and simultaneously heat onto the at least one outwardly facing ceramic fiber structure. It should however be noted that by optimizing the pressure, the heat and the compressing contact time between the forming mould 101 and the pressure mechanism 105, such a drying station will not be needed because an almost instant drying of the outwardly facing ceramic fiber structure will be achieved.

[0043] However, such a drying station 107 may in some (rare) occasions be needed when e.g. types, such as the thickness, of heat insulation components is changed and where there may be instances that the resulting heat insulation components may not be fully be dried. This should however typically not be the case, i.e. such a drying station 107 should according to the invention not be needed.

[0044] The system 100 may also comprise a pulper 108 adapted to tear down fibers or fiber blocks, a pulp storage tank 109 containing fibers acting as a buffer tank for the pulp 106, and the last tank is a water tank 110 that accumulates the water during the process, but all the water is preferably recycled.

[0045] Figure 2 depicts an embodiment of a pressure mechanism according to the present invention comprising a structure 201, or a plat structure, that may be e.g. be made of any type of alloy or steel alloy or stainless steel. The outer surface of the plate structure in this embodiment comprises three male like structures 202 essentially following three corresponding female structures of a forming mould shown in figure 3 that will be discussed in more details later. Each of the male like structures 202 comprise plurality of openings 203. The number of the male/female like structures should of course not be limited to three, but the number of such male/female structures could just as well be ten or even hundreds.

[0046] The structure 201 could of course instead of being a male like structure be a female like structure essentially following three corresponding male like structures of forming mould.

[0047] The pressure mechanism is operable connected to the heat mechanism, where the heat mechanism may comprise a heat source (H_S) 205 and a gas compression mechanism (G_C_M) 206. The heat source may be adapted to heat up compressed gas from the gas compression mechanism (G_C_M) 206 or to heat up gas before being compressed by the gas compression mechanism. The gas compression mechanism may be connected to an inner side of the structure 201. Due to the plurality of openings 203 in the male like structures a compressed hot air can be blown (not shown here) through the plurality of openings 203 from the inner side of the structure 201 through the plurality of openings to the outer side of the female or male like structure. The pressure of the compressed gas blown out through the plurality of openings to the outer side of the female or male like structure may be, but is not limited to, between 7-80bar, or between 30-70bar, or the range of 40-60bar, such as around 50bar. Moreover, the temperature of the compressed gas blown out through the plurality of openings to the outer side of the female or male like structure
This operation is preferably operated by a control unit (C_U) 204, that may be any type of industrial computer, that upon that the structure mould 301 in figure 3 approaches the structure 201 of the pressure mechanism, the control unit (C_U) 204 temporarily activates the above mentioned heating/blowing of hot gas, and subsequent to the compression between the structure 201 and the structure mould 301, after drying of the outwardly facing ceramic fiber structure, the control unit (C_U) 204 shots off the heating.

The control unit control unit (C_U) 204 may the same control unit that operates the computer controlled robotic arm that moves the structure mould, see e.g. figure 1.

The structure 201 shown here may e.g. be identical to the one shown in figure 1, where the movement of the structure 201 is operated by the robotic arm/system 102 shown in figure 1.

Figure 3 shows an embodiment of a structure mould 301 according to the present invention that may be used with the male mould 201 shown in figure 2, but as shown here the forming mould 301 is a female mould having a shape that essentially follows the shape of the male mold 201 in figure 2. The female mould 301 comprises corresponding three female like shapes 302 made of permeable moulding surface, but this permeable moulding surface may be made of a wire mesh 302 or any type of a plate structure of a robust and strong material having plurality of openings. The remaining part of the structure mould 301 may be a frame structure to remain high stability and strength of the structure mould 301.

The structure mould 301 may be operated by a robotic system (R_S) 303 that may be operated by a control unit (C_U) 304, e.g. similar as the one discussed in relation to figure 1. The control unit (C_U) 304 and the control unit (C_U) 204 discussed in relation to figure 2 may as an example be one and the same control unit.

The robotic system may comprise a robotic arm that may be operable connected to a vacuum source (V_S) 307, e.g. such as the one discussed in relation to figure 1, to supply the vacuum needed to draw pulp through the permeable surface side 302 leaving at least one outwardly facing ceramic fiber structure on the outer surface side of the forming mould, in this case three parallel strips or maps.

Although figures 2 and 3 depict graphically male/female moulds where the resulting heat insulation component is a two dimensional component or a two dimensional mat (where the resulting ends may have male and female shape, not shown here), all types of three dimensional heat insulation components may also be produced by the system according to the present invention, such as any types of cylindrical shape heat insulation component that may be open in both ends, or e.g. be open in one end.

Figure 4 shows an example of where three dimensional heat insulation components are produced using a forming mould and a pressing mechanism according to the present invention.

In this embodiment the forming mould may be a female mould 701 comprising plurality of cylindrical/cup-like male structures 702, and the pressing mechanism may comprise a male plate structure 703 having plurality of openings 704 that essentially follow the shape of the male structures 702.

The functioning of the heating mechanism (not shown) may be identical or similar as described in relation to figure 2, where the plurality of openings (not shown) are arranged at the bottom and/or the sides of the male parts 702. Vice verse, the upper plate/structure 701 may correspond to the plate structure discussed in relation to figure 2, where the plurality of male parts 702 have plurality of ventilation openings (not shown) at the top and/or the sides of the male parts 702, and the lower structure corresponds to the structure mould discussed in relation to figure 3.

Although the arrows indicate that the upper structure 701 is moving moved in relation to the lower structure 703, this could just as well be vice verse, i.e. that the lower structure 703 is moved in relation to the upper structure 701.

In this case, the resulting heat insulation component would be a three dimensional cylindrical shaped heat insulation component with a bottom part.

Figure 5 depicts graphically an embodiment of production steps showing graphically how heat insulation components for insulating heat generating components such as catalytic converter or any types of machinery parts may be produced according to the present invention.

For simplicity, it is assumed that the pressing mechanism comprises the structure 201 shown in figure 2, and that the forming mould 301 is the one shown in figure 3, and where both this structure 201 and the forming mould 301 are used to generate two dimensional heat insulation mats. Such two dimensional heat insulation mats may e.g. be utilized as heat insulators for catalytic converters in vehicles such as cars.

Other types of forming mould and pressing mechanism comprising different shaped structure, e.g. such as shown in figure 4, may of course be utilized to produce any types of e.g. three dimensional heat insulation components, using the same production steps as shown here.

Moreover, for simplicity it will be assumed that the moving mechanism is the robotic system comprising the computer controlled robotic arm discussed in relation...
to figures 1 and 2.

[0064] Figure 5a shows where the robotic arm 102 dips the forming mould 301 into the pulp 106 containing ceramic fibers.

[0065] Figure 5b shows where the robotic arm 102, that is connected to the vacuum source (see figure 1 and 3), transfers under-pressure p 503 from the vacuum source to the forming mould 301 and draws pulp through the permeable surface side of the forming mould 301 leaving thus ceramic fiber structures 504 on the outer surface side of the forming mould.

[0066] Figure 5c shows where, subsequent to drawing the pulp through the permeable surface side of the forming mould 301, the robotic arm 102 pulls the forming mould 301 out of the pulp 106, leaving at least one outwardly facing ceramic fiber structure 505 in wet form on the outer surface side of the forming mould, i.e. within the female openings of the forming mould 301. As depicted here, the vacuum force p 503 may still be applied during this step so as to maintain the ceramic fiber structure 505 within the female openings.

[0067] Figure 5d shows where the forming mould 301 is, subsequent to be removed from the pulp 106, moved by the robotic arm 102 in a direction as indicated by an arrow 506 towards the structure 201 of the pressure mechanism. The ceramic fiber structures 505 that have been accumulated within the female openings 302 of the forming mould 301 are facing the corresponding male structures of the structure 201 of the pressure mechanism. Shown is also the above mentioned plurality of openings of the male like structures.

[0068] Figure 5e shows where the forming mould 301 is moved towards the structure 201 of the pressure mechanism. As depicted here, the pressure of the gas, e.g. air, is blown out 507 of the openings shown in figure 5d (see also figure 2) of the structure 201 towards the outwardly facing ceramic fiber structures 505 before the forming mould 301 comes into contact with the structure 201. This does however not necessarily be the case, the blowing of the gas 507 out of the structure 201 may also occur upon a contact between the structure 201 and the forming mould 301.

[0069] A preferred pressure of the gas, e.g. air, and the temperature may be the same as discussed in relation to figure 2.

[0070] Figure 5f shows where the forming mould 301 is pressed towards the structure 201. The time where the structure 201 and the forming mould 301 are being pressed together may depend on the type and/or the thickness of the heat insulation component and may e.g. be from a fraction of a second up to one or several seconds, where simultaneously the above mentioned heat transfer occurs through the outwardly facing fiber structure 505 of the forming mould 301 occurs.

[0071] The pressure between the forming mould 301 and the structure 201 may be the same as discussed in relation to figure 2 and 3.

[0072] Figure 5g shows the step where the outwardly facing fiber structure 505 has been dried resulting in three dimensional heat insulation mats 505, and where the robotic arm 102 moves the forming mould 301 away from the structure.

[0073] Figure 5f shows where the robotic arm 102 is in the mode of releasing the resulting heat insulation components, in this case the two dimensional strips 505, from the forming mould 301.

[0074] The above mentioned steps may take only few seconds, i.e. from where the forming mould is put into the pulp until the robotic arm releases the dimensional strips 505 from the forming mould 301.

[0075] Figure 6 shows one example of a heat insulation component, but this heat insulation component may be heat insulation mat 600 that may be used to provide heat insulation for a heat generating component such as catalytic converter, but the heat insulation mat 600 may have a male 601 and female 602 ends to facilitate attaching the two ends together when circumferentially surrounding the catalytic converter, but the length of the heat insulation mat is preferably almost the same as the circumference of the catalytic converter (not shown).

[0076] Figure 7 shows one example of a heat insulation component 700, which in this case is a three dimensional cylindrical shaped heat insulation component that may be suitable for providing heat insulation for heat generating component such as catalytic converter.

[0077] Figure 8 shows an example where the cylindrical shaped heat insulation component shown in figure 7 is slide onto a cylindrical shaped catalytic converter 801, where the inner circumference of the cylindrical shaped heat insulation component is substantially the same as the outer circumference of the catalytic converter 800.

[0078] While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive; the invention is not limited to the disclosed embodiments. Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

Claims

1. A system (100) for producing heat insulation component (505, 600, 700) for insulating heat generating components, comprising:

• a forming mould (101, 301) comprising a permeable moulding surface (302),
• a moving mechanism (102) for moving the forming mould into pulp (106) containing ceramic fibers,
• a vacuum source (104, 307) connected to the forming mould for supplying vacuum to the forming mould so as to draw pulp through the permeable surface side leaving at least one outwardly facing ceramic fiber structure (505) on the outer surface side of the forming mould,
• a heat mechanism (103), and
• a pressure mechanism (105) connected to the heat mechanism for supplying a pressure and simultaneously heat onto the at least one outwardly facing ceramic fiber structure.

2. The system according to claim 1, wherein the forming mould (301) is a male or female forming mould, and wherein the pressure mechanism comprises a structure (201) which outer side has a female or male like shape (202) essentially following the shape of the male or female forming mould, wherein supplying the pressure onto the at least one outwardly facing ceramic fiber structure comprises compressing the forming mould having the at least one outwardly facing ceramic fiber structure and the outer side of the female or male like structure together.

3. The system according to claim 2, wherein the female or male like structure of the pressure mechanism comprises plurality of openings (203), and wherein the heat mechanism (103) comprises a heat source (205) and a gas compression mechanism (206) connected to the heat source, where the heat source is adapted to heat up compressed gas from the gas compression mechanism or to heat up gas before being compressed by the gas compression mechanism, and where the gas compression mechanism is connected to the female or male like structure of the pressure mechanism comprising the plurality of openings (203) and is adapted to blow pre-heated compressed gas (507) from an inner side of the female or male like structure through the plurality of openings (203) to the outer side of the female or male like structure.

4. The system according to claim 3, wherein the pressure of the compressed gas blown out through the plurality of openings (203) to the outer side of the female or male like structure is between 20-80bar, preferably between 30-70bar, more preferably in the range of 40-60bar, most preferably around 50bar.

5. The system according to claim 3 or 4, wherein the temperature of the compressed gas blown out through the plurality of openings to the outer side of the female or male like structure is in the range of 100-400°C, preferably between 200-300°C.

6. The system according to any of the preceding claims, wherein the supplied pressure between the forming mould and the pressure mechanism is in the range of 1*10⁵Pa-1*10⁷Pa, preferably in the range of 5*10⁵Pa-5*10⁶Pa, more preferably around 1*10⁶Pa, such as around 1.3*10⁶Pa.

7. The system according to any of the preceding claims, wherein the moving mechanism comprises a computer controlled robotic arm (102) that is connected to the vacuum source, the robotic arm being adapted:

• move the forming mould (301) into the pulp (106) containing the ceramic fibers,
• move the forming mould containing ceramic fibers (505) out of the pulp, and
• compress the forming mould (301) containing the ceramic fibers to the pressure mechanism (201).

8. A system according to any of the preceding claims, further comprising a drying station (107) for drying the heat insulation structures subsequent to the step of supplying the pressure and simultaneously heat onto the at least one outwardly facing ceramic fiber structure.

9. A system according to any of the preceding claims, wherein the heat insulation component has a shape selected from:

• a two dimensional shape and where the heat insulation component is a fiber mat (600),
• a three dimensional shape having a cylindrical or cylindrical like shape (700) such that the heat insulation component is open at both ends,
• a three dimensional shape having a cylindrical or cylindrical like shape and a bottom portion such that the heat insulation component is open at one end.

10. A method of producing heat insulation component for insulating heat generating components by a system according to any of the claims 1-9, comprising:

• moving the forming mould into pulp containing ceramic fibers,
• supplying vacuum to the forming mould so as to draw pulp through the permeable surface side leaving at least one outwardly facing ceramic fiber structure on the forming mould,
• supplying a pressure and simultaneously heat by the pressure and heat mechanism onto the at least one outwardly facing ceramic fiber structure.

11. The method according to claim 10, wherein the form-
ing mould is a male or female forming mould and the pressure mechanism comprises a structure which outer side has a female or male like shape essentially following the shape of the male or female forming mould, the step of supplying the pressure and simultaneously heat comprising:

- moving the forming mould with the at least one outwardly facing ceramic fiber structure towards the female or male like structure of the pressure mechanism, and
- compressing the forming mould and the female or male like structure together such that the male and female parts of the forming mould and the structure of the pressure mechanism engage with each other.

12. The method according to claim 11, wherein the female or male like structure of the pressure mechanism comprises plurality of openings, wherein prior to and/or during the compressing of the forming mould and the female or male like structure together, pre-heated compressed gas is injected from an inner side of the female or male like structure through the plurality of openings to the outer side of the female or male like structure.

13. The method according to claim 11 or 12, wherein the forming mould and the female or male like structure are compressed together for 0.5-1.5 seconds, preferably between 0.75-1.25 seconds, more preferably around 1 second.

14. A heat insulation structure produced by the method according to any of the claims 10-13 adapted to insulate a heat generating component.

15. The heat insulation structure according to claim 14, where the heat generating component is a catalytic converter.
### DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document with indication, where appropriate, of relevant passages</th>
<th>Relevant to claim</th>
<th>CLASSIFICATION OF THE APPLICATION (IPC)</th>
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<td>US 2 348 829 A (MACARTHUR ROGER A ET AL) 16 May 1944 (1944-05-16) * One can, of course, in the practice of this invention, use a filter mold in molding the low temperature heat insulaton composition especially when an excess of water is present and the molding may be under pressure.; claim 1; figure 6 *</td>
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The present search report has been drawn up for all claims.
## ANNEX TO THE EUROPEAN SEARCH REPORT
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