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(71) Applicant: **Vitesco Technologies GmbH**
93055 Regensburg (DE)

(72) Inventors:
- **Brück, Rolf**
  81737 München (DE)
- **Mihailescu, Adrian**
  81737 München (DE)
- **Harea, Adrian-Val**
  81737 München (DE)
- **Molnar, Laszlo**
  81737 München (DE)
- **Merceanu, Doru**
  81737 München (DE)

(74) Representative: **Vitesco Technologies**
Postfach 12 02
82019 Taufkirchen (DE)

(54) METHOD FOR MONITORING THE FUNCTION OF AN ELECTRICALLY HEATABLE CATALYST

(57) The invention relates to a method for monitoring the function of an electrically heatable catalytic converter, comprising a metallic honeycomb body with a multitude of flow channels, through which an exhaust gas can flow from an inlet side to an outlet side, with the honey comb body being electrically connected to a power source, through which the honeycomb body can be heated by using the ohmic resistance of the honeycomb body, with a control unit that is set up to measure a voltage and a current, whereby the control unit is used to measure the current and the voltage supplied to the honeycomb body at two different points with known boundary conditions and comparing the measurements with prestored values.

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Description

Technical field

[0001] The invention relates to a method for monitoring the function of an electrically heatable catalytic converter, comprising a metallic honeycomb body with a multitude of flow channels, through which an exhaust gas can flow from an inlet side to an outlet side, with the honey comb body being electrically connected to a power source, through which the honeycomb body can be heated by using the ohmic resistance of the honeycomb body, with a control unit that is set up to measure a voltage and a current.

State of the art

[0002] Electric heating sources are increasingly being used to heat exhaust gases from an internal combustion engine. This is particularly the case in view of increasingly stringent exhaust gas legislation. Particularly advantageous here is the use of electrically heatable catalytic converters, which can be installed in the exhaust tract and can thus heat the exhaust gas directly. Electrically heatable catalytic converters are already known in the prior art in a variety of embodiments.

[0003] In order to ensure the correct function of the heating source and in particular the electrically heated catalytic converter, it must be continuously monitored to ensure that exhaust gas aftertreatment can take place at all times in accordance with the legal framework conditions.

[0004] In prior art solutions, temperature sensors are regularly used for monitoring. Activation of the electrical heating source generates a sudden change in temperature, which can be measured by the temperature sensor. The temperature increase that occurs during activation can be used to conclude that the heating source is functioning correctly.

[0005] A particular disadvantage of the prior art devices is that the temperature sensor is an additional component which must be provided. Furthermore, the installation of the temperature sensor is a problem, since the installation location should be as close as possible to the heat source, but at the same time electrical insulation from the heat source must be ensured in order to avoid short circuits. In addition, electrically heatable catalytic converters are often arranged via support means on downstream support catalytic converters. Temperature measurement is then only possible downstream of the respective supporting catalyst, resulting in dead times when measuring the temperature. In addition, the heat capacity of the supporting catalyst and the exothermic reactions taking place in it can lead to an unwanted impairment of the temperature measurement.

Presentation of the invention, task, solution, advantages

[0006] Therefore, it is the object of the present invention to provide a method which allows continuous monitoring of the function of the electrically heatable catalyst.

[0007] The task with respect to the method is solved by a method having the features of claim 1.

[0008] One embodiment of the invention relates to a method for monitoring the function of an electrically heatable catalytic converter, comprising a metallic honeycomb body with a multitude of flow channels, through which an exhaust gas can flow from an inlet side to an outlet side, with the honey comb body being electrically connected to a power source, through which the honeycomb body can be heated by using the ohmic resistance of the honeycomb body, with a control unit that is set up to measure a voltage and a current, whereby the control unit is used to measure the current and the voltage supplied to the honeycomb body at two different points with known boundary conditions and comparing the measurements with prestored values.

[0009] By measuring the current and the voltage with which the honeycomb body is supplied, the electrical resistance of the honeycomb can be calculated. The electrical resistance of the honeycomb body will change when the temperature of the honeycomb body changes. By calculating the electrical resistance at two specific points in time, the change in electrical resistance due to the temperature change can be recorded and thus the functionality of the heating element can be concluded.

[0010] It is particularly advantageous if the gradient of the electrical resistance based on the temperature change of the honeycomb body is calculated from the measured values of the current and the voltage. The gradient of the electrical resistance is an advantageous quantity to infer the function of the heating element, since the change in electrical resistance is directly linearly related to the change in temperature.

[0011] It is also advantageous if the four-wire technique is used to do the two measurements. The four-wire technique is particularly preferable, as it allows a particularly accurate recording of the values to be measured. The measurement error that occurs is significantly reduced compared to other measurement methods, which improves the quality of the results.

[0012] A preferred embodiment is characterized in that the change of the electrical resistance of the honeycomb body over time is measured. This allows to determine the functionality of the heating element very easily, as the change of the electrical resistance can be calculated form the measured values for the current and the voltage can be measured very accurately.

[0013] It is also preferable if the first point at which the measurement takes place is right before the engine start, when the exhaust treatment system is at a temperature level of the surrounding, and the second point is after two seconds of heating the honeycomb body without a mass

flow from the engine.

[0014] The first measurement point is ideally at a point before the engine start, where the temperature of the honeycomb body can be assumed as similar to the surrounding temperature. The electrical resistance should be equal to the known specific resistance of the used material of the honeycomb body. The second measurement point is preferably two seconds after the heating of the honeycomb body was started, but without any mass flow from the engine. The mass flow of the engine could, depending on the temperature of the exhaust gas, heat up the honeycomb body so that an increase in temperature could happen and thus a change of the electrical resistance would be recorded. This would lead to a wrong conclusion as the heating of the honeycomb body would not necessarily come from the heating function itself. The additional heat from the exhaust gas is therefore a factor of a source of error, which can easily be eliminated by measuring before a mass flow from the engine occurs.

[0015] In a preferred embodiment the first and the second measurement can be triggered right before the engine start. The engine start itself can be anticipated and be predicted by using multiple sensors in the vehicle to predict the wish of the driver to start the engine. Another advantageous time for the measurements is the timespan, which is used to preheat the glow plugs in case of a diesel engine.

[0016] Furthermore, it is advantageous if the change of the electrical resistance over time due to the heating of the honeycomb body is compared to a prestored value. The comparison with a prestored value is advantageous to be able to detect changes. This makes it possible to detect whether there has been a change in the material property, for example as a result of damage or aging.

[0017] Furthermore, it is advantageous if the electrical resistance of the honeycomb body is calculated by measuring the current and the voltage at the honeycomb body. This is advantageous as it is a reliable calculation which can be done easily.

[0018] Advantageous further embodiments of the present invention are described in the subclaims.

Claims

1. Method for monitoring the function of an electrically heatable catalytic converter, comprising a metallic honeycomb body with a multitude of flow channels, through which an exhaust gas can flow from an inlet side to an outlet side, with the honey comb body being electrically connected to a power source, through which the honeycomb body can be heated by using the ohmic resistance of the honeycomb body, with a control unit that is set up to measure a voltage and a current, **characterized in that** the control unit is used to measure the current and the voltage supplied to the honeycomb body at two different points with known boundary conditions and comparing the measurements with prestored values.

2. Method according to claim 1, **characterized in that** the gradient of the electrical resistance based on the temperature change of the honeycomb body is calculated from the measured values of the current and the voltage.

3. Method according to any one of the preceding claims, **characterized in that** the four-wire technique is used to do the two measurements.

4. Method according to any one of the preceding claims, **charac-terized in that** the change of the electrical resistance of the honeycomb body over time is measured.

5. Method according to any one of the preceding claims, **charac-terized in that** the first point at which the measurement takes place is right before the engine start, when the exhaust treatment system is at a temperature level of the surrounding, and the second point is after two seconds of heating the honeycomb body without a mass flow from the engine.

6. Method according to any one of the preceding claims, **charac-terized in that** the change of the electrical resistance over time due to the heating of the honeycomb body is compared to a prestored value.

7. Method according to any one of the preceding claims, **charac-terized in that** the electrical resistance of the honeycomb body is calculated by measuring the current and the voltage at the honeycomb body.

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EUROPEAN SEARCH REPORT

Application Number
EP 21 46 5535

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 2011/268613 A1 (HIRAI TARO [JP] ET AL) 3 November 2011 (2011-11-03) * paragraphs [0143], [0056], [0075]; claim 1; figures 1-5 *	1,2,4-7 1-7	INV. F01N3/20 F01N3/28
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TECHNICAL FIELDS SEARCHED (IPC)
F01N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 November 2021	Seifert, Marco

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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