

SPECIFICATION

Method for cleaning of reaction products from a flame combustion

5 The invention relates to a method of cleaning reaction products which result from flame combustion of high calorific value fuels containing impurities such as sulphur, chlorine and fluorine compounds, by the addition of additives binding the impurities in the combustion chamber.

10 Methods are known whereby a dry cleaning of reaction products from the combustion of fuels containing impurities such as sulphur, chlorine and fluorine, can be carried out. In these cases, the additives binding the impurities are introduced into the combustion chamber in various ways.

15 In a first known method, the procedure is such that the additives are injected into the combustion chamber, above the flame region, by means of jets of air. The disadvantage of this known method consists in that the method of introducing the additives into the combustion chamber does not ensure the binding of the impurities by the additives because the relatively
25 small mixing energy of the jets of air is not sufficient to achieve a satisfactory degree of mixing of the reaction partners. In addition, the mixing of the reaction partners is effected mainly in temperature regions which do not ensure the optimum reaction
30 conditions. Furthermore, the available dwell time is insufficient for the conclusion of the reaction because the injection of the additives is generally effected in regions where the reaction is slow.

In a second known method, the procedure is such
35 that the additives are admixed with the fuel immediately before the fuel is introduced into the burner. What was unfavourable about this method up till now was that the additives were subjected to the whole temperature spectrum of the flame and had to
40 travel through temperature ranges which led to an inactivation of the additive. This applies, in particular, to fuels with a high calorific value which necessarily lead to flames with high temperatures.

It is therefore the object of the present invention to
45 influence the flame temperature of the combustion of high calorific value fossil fuel in such a way with regard to temperature and degree of mixing to provide the necessary conditions for the binding of harmful substances, so that the binding of the
50 harmful substances is carried out during combustion through addition of gaseous or fine grained additives.

For the solution of this problem it is proposed according to the invention that part of the heat
55 released by combustion of the high calorific value fuel is absorbed by a stream of heat absorbing material introduced directly into the combustion zone so as to restrict the temperature to that necessary for binding the harmful substances and
60 that the additives are added direct to the fuel and/or the combustion air to obtain the necessary degree of mixing of the reaction partners.

Various materials may be used for the stream of heat absorbing material for limiting the temperature
65 necessary for the reaction. According to one embodiment of the method of the invention, oxygen-poor cooled-down exhaust gas fed by return flow from the combustion process, or cooled-down exhaust gas from an external combustion process, can serve as the stream of heat absorbing material.

70 The invention also provides the possibility of using the exhaust gas from a gas turbine process at the same time as oxidising means and as a stream of heat absorbing material.

75 Another possibility is that recirculating exhaust gas inside the combustion chamber can be drawn into the flame and serve as the stream of heat absorbing material.

According to the invention, the additive itself can
80 serve as the stream of heat absorbing material, as for example, with the addition of limestone, for example Dolomite, for the calcination of which energy has to be withdrawn from the flame.

Gases capable of reaction, metallic oxides, hydroxides or carbonates as well as their aqueous suspensions can serve as additives.

By the addition of the stream of heat absorbing material in the region of the flame, there is obtained for the reaction the necessary temperature and
90 degree of mixing of the additives contained in the fuel and/or in the combustion air.

The use of the method according to the invention is described below by way of example with reference to a coal-dust burner (Figure 1).

95 With the burner consisting of core air tube 2, fuel-additive carrier-air part 1 and jacket air part 3, a primary combustion zone 6 is produced, the air number of which is between 0.6 and 1.1 times the stoichiometry.

100 The burner is so constructed that by specific means (swirl of the jacket air, burner mouth widened out in a taper, closed core air) in the interior of the flame a zone of intensive return flow 5 from a region of already advanced combustion is produced. As a
105 result, the mixture of fuel and air is quickly heated and ignited. The heating and ignition can be influenced by adjusting the amount of core air.

The remaining combustion air is blown in through some nozzles at the periphery as a component
110 stream of air 4 (also called stage air stream) which forms the secondary flame or post-reaction zone 7 outside the primary flame.

At the sections of the peripheral area of the flame which are not adjacent to the component air flow, the cold flue gases are drawn in from the combustion chamber by pulse exchange. By this means, the flame temperature is lowered which contributes to a favourable influencing of the course of the reaction between additive and gaseous harmful substances.

120 CLAIMS

1. A method of cleaning reaction products which result from flame combustion of high calorific value
125 fuels containing impurities such as sulphur, chlorine and fluorine compounds by the addition of additives binding the impurities in the combustion chamber, characterised in that part of the heat released by combustion of the high calorific fuel is absorbed by a
130 stream of heat absorbing material introduced direct-



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10 Methods are known whereby a dry cleaning of reaction products from the combustion of fuels containing impurities such as sulphur, chlorine and fluorine, can be carried out. In these cases, the additives binding the impurities are introduced into the combustion chamber in various ways.

15 In a first known method, the procedure is such that the additives are injected into the combustion chamber, above the flame region, by means of jets of air. The disadvantage of this known method consists in that the method of introducing the additives into the combustion chamber does not ensure the binding of the impurities by the additives because the relatively small mixing energy of the jets of air is not sufficient to achieve a satisfactory degree of mixing of the reaction partners. In addition, the mixing of the reaction partners is effected mainly in temperature regions which do not ensure the optimum reaction conditions. Furthermore, the available dwell time is insufficient for the conclusion of the reaction because the injection of the additives is generally effected in regions where the reaction is slow.

20 In a second known method, the procedure is such that the additives are admixed with the fuel immediately before the fuel is introduced into the burner. What was unfavourable about this method up till now was that the additives were subjected to the whole temperature spectrum of the flame and had to travel through temperature ranges which led to an inactivation of the additive. This applies, in particular, to fuels with a high calorific value which necessarily lead to flames with high temperatures.

25 It is therefore the object of the present invention to influence the flame temperature of the combustion of high calorific value fossil fuel in such a way with regard to temperature and degree of mixing to provide the necessary conditions for the binding of harmful substances, so that the binding of the harmful substances is carried out during combustion through addition of gaseous or fine grained additives.

30 For the solution of this problem it is proposed according to the invention that part of the heat released by combustion of the high calorific value fuel is absorbed by a stream of heat absorbing material introduced directly into the combustion zone so as to restrict the temperature to that necessary for binding the harmful substances and that the additives are added direct to the fuel and/or the combustion air to obtain the necessary degree of mixing of the reaction partners.

35 Various materials may be used for the stream of heat absorbing material for limiting the temperature necessary for the reaction. According to one embodiment of the method of the invention, oxygen-poor cooled-down exhaust gas fed by return flow from the combustion process, or cooled-down exhaust gas from an external combustion process, can serve as the stream of heat absorbing material.

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50 According to the invention, the additive itself can serve as the stream of heat absorbing material, as for example, with the addition of limestone, for example Dolomite, for the calcination of which energy has to be withdrawn from the flame.

55 Gases capable of reaction, metallic oxides, hydroxides or carbonates as well as their aqueous suspensions can serve as additives.

60 By the addition of the stream of heat absorbing material in the region of the flame, there is obtained for the reaction the necessary temperature and degree of mixing of the additives contained in the fuel and/or in the combustion air.

65 The use of the method according to the invention is described below by way of example with reference to a coal-dust burner (Figure 1).

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75 The burner is so constructed that by specific means (swirl of the jacket air, burner mouth widened out in a taper, closed core air) in the interior of the flame a zone of intensive return flow 5 from a region of already advanced combustion is produced. As a result, the mixture of fuel and air is quickly heated and ignited. The heating and ignition can be influenced by adjusting the amount of core air.

80 The remaining combustion air is blown in through some nozzles at the periphery as a component stream of air 4 (also called stage air stream) which forms the secondary flame or post-reaction zone 7 outside the primary flame.

85 At the sections of the peripheral area of the flame which are not adjacent to the component air flow, the cold flue gases are drawn in from the combustion chamber by pulse exchange. By this means, the flame temperature is lowered which contributes to a favourable influencing of the course of the reaction between additive and gaseous harmful substances.

CLAIMS

1. A method of cleaning reaction products which result from flame combustion of high calorific value fuels containing impurities such as sulphur, chlorine and fluorine compounds by the addition of additives binding the impurities in the combustion chamber, characterised in that part of the heat released by combustion of the high calorific fuel is absorbed by a stream of heat absorbing material introduced direct-

ly into the combustion zone so as to restrict the temperature to that necessary for binding the harmful substances and that the additives are added direct to the fuel and/or the combustion air to obtain

5 the necessary degree of mixing of the reaction partners.

2. A method according to claim 1, characterised in that oxygen-poor cooled-down exhaust gas fed by return flow from the combustion process or from an
10 external combustion process serves as the stream of heat absorbing material.

3. A method according to claims 1 and 2, characterised in that exhaust gas from a gas turbine process serves at the same time as oxidising means
15 and as the stream of heat absorbing material.

4. A method according to claim 1, characterised in that recirculating exhaust gas inside the combustion chamber is drawn into the flame and serves as the stream of heat absorbing material.

20 5. A method according to any of claims 1-4, characterised in that gases capable of reaction, or metallic oxides, hydroxides or carbonates as well as their aqueous suspensions are used as additives.

6. A method according to claim 5, characterised
25 in that the additives also serve at the same time as a stream of heat absorbing material.

7. A method of cleaning reaction products which result from flame combustion of high calorific value fuels containing impurities, substantially as hereinbefore described, with reference to the accompanying
30 drawing.

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