Further documents related to coating or barrier layers include EP2143819A1 WO2011100019A1, EP1944551A1, EP659709A1 and US5118647A.

In EP 1 164 330 is disclosed a superheater tube comprising nickel in order to reduce corrosion. According to EP 1 164 330 a higher efficiency, and lower corrosion is achieved by reheating the steam leaving the first turbine by using steam A' from the steam drum. This gives a higher efficiency and a lower steam and pipe temperature.

~~It is thus an object~~ Embodiments of the present invention seek to provide a heat exchanger having enhanced corrosion resistance.

~~It is a further object~~Embodiments of the present invention seek to provide a heat exchanger for increasing the efficiency of an incineration plant producing superheated steam.

~~It is a yet a further object~~Embodiments of the present invention seek to provide a method for forming a scale for protecting a heat exchanger component against corrosion caused by corrosive compounds entrained or comprised by a flue gas.

~~At least one of the above objects, or at least one of further objects which will be evident from the below description, are according to a first aspect of the present invention achieved by the heat exchanger according to claim 1.~~

According to a first aspect, there is provided a heat exchanger for heating a fluid in a waste to energy incineration plant, said incineration plant in operation producing a flue gas, said heat exchanger comprising at least one heat exchanger component comprising a wall having a first side in contact with said fluid, and a second side in contact with said flue gas, said second side being provided with a protective coating for protecting said heat exchanger component against corrosion caused by corrosive compounds entrained or comprised by said flue gas, characterized in that said protective oxide comprises α-Al_2O_3.

α-Al_2O_3, also called alpha-alumina, is an aluminium oxide which is highly corrosion resistant. Thus the protective oxide has the effect of increasing the corrosion resistance of the heat exchanger. As the corrosion resistance is increased the fluid

can be heated at higher temperatures, thus allowing the efficiency of heating the fluid to be increased while still maintaining an acceptable service life of the heat exchanger. The fluid may be any fluid suitable for being heated. Typically the fluid is water or steam. For a fluid such as steam the heat exchanger according to the first aspect of the present invention may be used with steam temperatures of above at least 480°C with a service life of at least 5 years. It is further contemplated that steam temperatures of up to 600°C can be used with at least 5 years of service life.

The incineration plant may incinerate fuels such as coal, other fossil fuels, biomass, demolition wood chips, refuse derived fuels, or waste. In the context of embodiments of the present

M 21	0.13	6	5.7	Bal	-	-	2.0	11.0	0.12Zr, 1.5Cb, 0.02B
M 22	0.13	6.3	5.7	Bal	-	-	2.0	11.0	3Ta, 0.6Zr
MAR-M 200	0.15	5	9.0	Bal	10.0	1.0	-	12.5	2Ti, 0.05Zr, 0.015B, 1.0Cb
MAR-M 246	0.15	5.5	9.0	Bal	10.0	-	2.5	10.0	1.5Ti, 1.5Ta, 0.05Zr, 0.015B
RENE 100	0.16	5.5	9.5	Bal	15.0	-	3.0	-	4.2Ti, 0.006Zr, 0.015B
TAZ-8A	0.12	6	6.0	Bal	-	-	4.0	4.0	8Ta, 1Zr, 2.5Cb, 0.004B
TAZ-8B (DS)	0.12	6	6.0	Bal	5.0	-	4.0	4.0	8Ta, 1Zr, 1.5Cb, 0.004B

A preferred embodiment of the first aspect of present invention is defined in dependent claim 10. The incineration plant may be a waste to energy incineration plant generating both heat for use in for example area heating and steam for electrical power generation. The waste may be household waste or industrial waste, preferably the waste is household waste or light industrial waste.

The α-Al_2O_3 is resistant to corrosive compounds such as S, O_2, H_2O, Cl_2, N_2, CO/CO_2 etc. Other corrosive compounds which may form in an incineration plant include Na, Ca, Cu, K, Cl, S, Cr, Pb, Zn, Fe, Sn and Al.

By the preferred embodiment of the first aspect of the present invention as defined in dependent claim 11 the heat exchanging capacity of the heat exchanger is increased. The heat exchanger is preferably a superheater comprising typically 150 to 300 superheater tubes.

By the preferred embodiment of the first aspect of the present invention as defined in dependent claim 12 a heat exchanger component which is easy to form and which is suitable for heating a liquid in an incineration plant is provided. Further a tube is suitable where the liquid is pressurized, such as for example superheated steam. Where the heat exchanger is a superheater and the heat exchanger component is a superheater tube, the superheater tube typically up to 6 m long.

~~At least one of the above mentioned and further objects are moreover achieved by~~ According to a second aspect, there is provided ~~of the present invention pertaining to~~ a method of forming a scale for protecting a heat exchanger component against corrosion caused by corrosive compounds entrained or comprised by a flue gas, comprising the steps of: providing a heat exchanger component comprising a precursor material arranged for protecting the heat exchanger component after

oxidation against said corrosion, said precursor material comprising aluminium, oxidizing said heat exchanger component at a temperature, atmosphere and for a time adapted to form said scale on said precursor material, said scale comprising predominantly α-Al_2O_3 ~~according to claim 13~~.

CLAIMS

1. A heat exchanger ~~(32)~~ for heating a fluid ~~(26)~~ in a waste to energy incineration plant ~~(2)~~, said incineration plant ~~(2)~~ in operation producing a flue gas ~~(34)~~, said heat exchanger comprising at least one heat exchanger component ~~(40)~~ comprising a wall having a first side ~~(46)~~ in contact with said fluid ~~(26)~~, and a second side ~~(48)~~ in contact with said flue gas ~~(34)~~, said second side ~~(48)~~ being provided with a protective coating ~~(50)~~ for protecting said heat exchanger component ~~(40)~~ against corrosion caused by corrosive compounds entrained or comprised by said flue gas ~~(34)~~, characterized in that said protective oxide ~~(50)~~ comprises α-Al_2O_3.

2. The heat exchanger ~~(32)~~ according to claim 1, said fluid ~~(26)~~ being steam and said heat exchanger ~~(32)~~ being a superheater ~~(32)~~ for superheating said steam ~~(26)~~.

3. The heat exchanger ~~(32)~~ according to any preceding claim, said protective oxide ~~(50)~~ being a scale ~~(50)~~.

4. The heat exchanger ~~(32)~~ according to claim 3, said heat exchanger component ~~(40)~~ being made from a precursor material forming said scale ~~(50)~~ upon oxidation.

5. The heat exchanger ~~(32)~~ according to claim 3, said heat exchanger component ~~(40^{I})~~ comprising a base material ~~(44^{I})~~ coated by a precursor material ~~(54)~~ forming said scale ~~50)~~ upon oxidation.

6. The heat exchanger ~~(32)~~ according to claim 3, said precursor material ~~(54)~~ being coated upon said base material ~~(44^{I})~~ by welding.

7. The heat exchanger ~~(32)~~ according to claim 3, said heat exchanger component ~~(40^{II})~~ comprising an inner tube ~~(44^{II})~~ covered by an outer tube ~~(56)~~, said outer tube ~~(56)~~ being made from a precursor material forming said scale ~~(50)~~ upon oxidation.

8. The heat exchanger ~~(32)~~ according to claim 7, said inner tube ~~(44^{II})~~ and said outer tube ~~(56)~~ being co-extruded.

9. The heat exchanger ~~(32)~~ according to any of the claims 4-8, said precursor material comprising an alloy comprising at least 4-5 wt.% aluminium.

10. The heat exchanger ~~(32)~~ according to any preceding claim, said incineration plant ~~(2)~~ in operation incinerating waste and said corrosive compounds comprising chlorine.

11. The heat exchanger ~~(32)~~ according to any preceding claim, said heat exchanger ~~(32)~~ comprising a plurality of said heat exchanger components ~~(40)~~.

12. The heat exchanger ~~(32)~~ according to any preceding claim, said heat exchanger component ~~(40)~~ being a tube.

13. A method of forming a scale ~~(50)~~ for protecting a heat exchanger component ~~(40)~~ *in a waste to energy incineration plant against corrosion caused by corrosive* compounds entrained or comprised by a flue gas ~~(34)~~, comprising the steps of:

providing a heat exchanger component ~~(40)~~ comprising a precursor material arranged for protecting the heat exchanger component after oxidation against said corrosion, said precursor material comprising aluminium,

oxidizing said heat exchanger component ~~(40)~~ at a temperature, atmosphere and for a time adapted to form said scale ~~(50)~~ on said precursor material, said scale ~~(48)~~ comprising predominantly α-Al_2O_3.

14. The method of claim 13, said temperature being at least 950°C, more preferably 1100°C to 1200°C.

15. The method of any of the claims 13-14, said atmosphere comprising an Argon-Hydrogen mixture containing 2% water vapour.

16. The method of any of the claims 13-15, said time being at least 2 hours.