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SLAG CONTROL

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This invention relates to the control of slag formation in furnaces and more particularly to a composition and method for control and removal of slag deposits in furnaces.

It has been previously proposed in coal burning furnaces to periodically apply various slag and soot removers to the fuel bed or furnace for the purpose of removing slag and soot deposits in the furnace, flue pipes, chimney, etc. When the fuel is burned, the slag and soot remover is volatilized and upon contact with the slag and soot lowers the ignition temperature of the latter, thereby facilitating the burning and removal thereof. Although these removers do effect a certain control of the soot and slag, the results obtained have varied, depending upon the conditions encountered. For the most part, these removers have been effective with soot removal, but only in isolated instances have the removers been effective in slag control and removal.

It is an object of the present invention to provide a composition and particularly a method of procedure which results in improved control of slag formation and its periodic removal from furnace walls, pipes and the like.

It is a further object of the invention to provide a new composition useful as a slag eliminator or preventive.

It is a still further object of the invention to provide a new method of using same in a furnace whereby the usual lancing treatment results in slag removal.

Other objects and the nature and advantages of the instant invention will be apparent from the following description.

The procedure in accordance with this invention is to apply the slag remover to the exposed surfaces of a furnace where the slag ordinarily builds up. Following this application, the furnace is permitted to continue to build up slag on the coating of slag remover, in the normal manner, during operation of the furnace. Periodically thereafter, a lancing treatment is applied which results in a detachment of the slag at the interface of the slag remover and the slag, thus effectively preventing build-up of slag.

The essential ingredients of the slag remover are one or more chlorides preferably in combination with an adhesive type material that performs in this medium of extremely high temperatures, in the following proportions:

	Percent
Chlorides	50–95
Adhesive	5–50
Other additives	0–40

Other additives, such as borax, sulfur, ammonium, sulfate, lampblack, coal dust, charcoal, zinc, zinc oxide, lead, lead oxide, tin, antimony, aluminum, copper sulfate, tin sulfate, zinc sulfate, antimony sulfate, sodium or potassium nitrate, lead nitrate, potassium permanganate, manganese dioxide, sodium carbonate, calcium carbonate, magnesium carbonate, lead carbonate, and similar materials can likewise be included. These additives are utilized to modify the nature of the interposed coating layer so as to promote cleavage when lanced.

As the chlorides, there may be utilized one or more of the following:

Sodium chloride
Ammonium chloride
Potassium chloride
Zinc chloride
Calcium chloride
Nickel chloride
Iron chloride
Stannous chloride
Copper chloride
Manganese chloride
Lead chloride
Tin chloride
Chromium chloride, and
Similar chlorides.

In place of the chloride itself, a mixture of the metal, or a salt of it other than the chloride, with another chloride, give equally good results. For example, zinc and ammonium chloride may be added to yield a zinc chloride. Since sodium chloride is the cheapest chloride, it is one most commonly used.

As the adhesive agent, there may be used gum arabic, gum tragacanth, dextrine, starch, gum acacia, cedar gum, Indian gum, and the like. The term "adhesive" as used herein broadly includes any organic water soluble substance that upon drying binds materials together.

Some typical examples of compositions that can be used are:

Example I

	Percent
Sodium chloride	63
Zinc dust	25
Charcoal	2
Adhesive	10

Example II

Sodium chloride	80
Sodium carbonate	5
Calcium carbonate	4
Coal dust	1
Adhesive	10

Example III

Sodium chloride	85
Potassium permanganate	4
Manganese dioxide	1
Adhesive	10

Example IV

Sodium chloride	90
Adhesive	10

Example V

Cupric chloride	90
Adhesive	10

Example VI

Cuprous chloride	15
Lead chloride	25
Zinc chloride	50
Adhesive	10

Example VII

Sodium chloride	75
Lead or zinc	15
Adhesive	10

Example VIII

Ammonium chloride	45
Lead or zinc	45
Adhesive	10

Example IX

Sodium chloride	50
Zinc oxide	30
Zinc sulfate	3
Manganese dioxide	10
Adhesive	7

Example X

Sodium chloride	75
Borax	3
Sulfur	2
Zinc	10
Adhesive	10

The above examples are merely illustrative of a large number of compositions that can be used in conjunction with this method.

The composition to be utilized is preferably made into a solution or slurry and is sprayed wet onto the exposed surface of the slag in a furnace which has already been in operation. The composition firmly adheres to the surface and dries thereon forming a coating. The adhesive has been found desirable and for best results essential to aid in the adhesion of the composition to the surface while drying thereon, although the function is transient. Utilizing identical compositions with the omission of the adhesive does not give comparable results. Similarly, dry application, with and without adhesive, while giving results to a degree, does not give the same measure of effectiveness. The layer of composition is weaker and more porous than the dense fused mass of slag layer.

Following the application of the composition, the furnace is operated in the normal manner, permitting slag to accumulate in the normal way over the coating. When the slag has built up to the point where it must be removed, the lancing method of cleaning is utilized. During the lancing operation, the slag breaks off at the point of weakness, namely, at the porous weak layer of material previously applied and of composition stated.

This method has been applied successfully in conjunction with furnaces and boilers which use steel mill blast furnace gases as fuel. These gases are known to run high in entrained slag forming materials. It has also been used with equally beneficial results in conjunction with other fuels, such as coal, oil, gas and mixtures.

It is believed that the weakness of the interposed layer of composition is due to the slag and composition forming a mixture of a different fusion point and a different density at the interface. Examination of this layer shows it to be more porous as compared with the dense fused slag.

It has been noted that in normal operation of a furnace, the slag tends to fuse and flow to the bottom in a dense form. After the spray treatment in accordance with the present invention, it is noted that the slag tends to accumulate at the point of deposition and if not removed by the subsequent lancing step has been frequently noted to break off at the weak interface of its own accumulated weight. It is further believed that the fused dense slag below and above the more porous surface has different coefficients of expansion and due to the heat of the furnace, there is believed to be continuous molecular movement, which causes further weakness in that area.

The lancing step can be accomplished by steam, air or hot water under pressure. In the normal accumulation of slag in a furnace, thermal shock itself is not sufficient to break away the slag. However, with the weak layer of a different coefficient of expansion, thermal shock does aid in the slag removal.

Utilizing the method of this invention on the checkers of an open hearth steel furnace, it has been found to increase the campaign life from approximately 50 heats to over 300 heats.

The method is particularly applicable in boilers where waste gases loaded with iron oxide are burned which result in the formation of slag.

It will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention and therefore the invention is not limited to what is described in the specification, but only as indicated in the appended claims.

What is claimed is:

1. A method of removal of residual deposits of slag that accumulate in a furnace during normal operation, comprising spraying a material onto the inner surfaces of said furnace which are to be in contact with the hot combustion gases, said material including at least 50% of a chloride salt and at least 5% of an adhesive material combined with water, said material being capable of drying on said surfaces to form a layer of material having a lower fusion point and being weaker and more porous than the slag, drying said material to form said porous layer, operating said furnace in a normal manner until slag deposits form on said porous layer beyond a predetermined thickness, and lancing said inner surfaces until said built-up deposit of slag breaks off at the interface of said porous layer and said slag layer, said lancing resulting in a more rapid and more uniform removal of the slag deposit due to said porous layer.

2. A method in accordance with claim 1, wherein the material consists of a chloride salt 63%, zinc dust 25%, charcoal 2%, an adhesive gummy material 10%, all mixed with water and capable of being sprayed onto the inner surfaces of said furnace which are to be in contact with the hot combustion gases, said adhesive material being an organic water soluble material capable of binding the materials together and to the furnace surfaces when dry to form a porous coating thereon.

3. A method in accordance with claim 1, wherein the material consists of a chloride salt 75%, zinc dust 10%, borax 3%, sulfur 2%, an adhesive gummy material 10%, all mixed with water and capable of being sprayed onto the inner surfaces of said furnace which are to be in contact with the hot combustion gases, said adhesive material being an organic water soluble material capable of binding the materials together and to the furnace surfaces when dry to form a porous coating thereon.

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