

DESCRIPTION

REFRACTORY COATING MATERIAL

5 Technical Field

[0001]

The present invention relates to a refractory coating material used to improve refractoriness of a steel frame building, or the like.

10 Background Art

[0002]

A building with steel structure have risks that, when steel-made beam or pillar is exposed to high temperatures when a fire breaks out, steel frame materials are softened and cannot withstand a load any longer, and as a result, problems occur that floors are crumbled and the walls are fallen down or the like, leading to collapse of the building. Therefore, it is known that, refractoriness of buildings is improved by coating the surface of steel frame materials with a refractory heat-insulating material. For example, in a steel frame pillar formed of an H-steel, as shown in Fig. 1 of the cited document 1, a refractory coating material made of rock wool or the like is wound around such that it fits along the shape of the H-steel.

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Related Art Document

Patent Document

[0003]

Patent Document 1: JP-A-H10-152913

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Summary of the Invention

Problems to be Solved by the Invention

[0004]

In Patent Document 1, a refractory coating material in which aluminum foil is stacked on felt made of rock wool is exemplified. When winding such a refractory coating material in the form of a roll for transportation and storage or winding such a refractory coating material such that it fits along the shape of a steel frame material such as an H-steel, conspicuous creases may be formed in aluminum foil, making the appearance after the construction poor. In particular, when a refractory coating material is wound such that it is bent along a front end part of a flange part of an H-steel, the aluminum foil may be torn. In such a case, construction is required to be conducted again by preparing a new refractory coating material.

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[0005]

The present invention has been made in view of the above-mentioned circumstances, and is aimed at providing a refractory coating material formed by stacking an external material layer including at least a metal foil layer, wherein formation of conspicuous creases in the metal foil layer or tearing of the metal foil layer can be suppressed.

Means for Solving the Problem

[0006]

The refractory coating material according to the present invention is a refractory coating material formed by stacking an external material layer including at least a metal foil layer on a heat-insulating material layer composed of a flame-retardant fibrous material, wherein at least the metal foil layer is subjected to an irregularity-imparting processing.

Advantageous Effects of the Invention

[0007]

The refractory coating material according to the present invention can suppress formation of conspicuous creases when winding in the form of a roll for transportation and storage or winding around steel frame materials such as an H-steel at the time of construction. Further, when winding such that it is bent along a front end part of a flange part of an H-steel, irregularity formed on the metal foil layer is extended, thereby to prevent the metal foil layer from being torn.

Brief Description of the Invention

[0008]

Fig. 1 is a cross-sectional view showing an outline of one example of the refractory coating material according to the embodiment of the present invention; and

Fig. 2 is a cross-sectional view showing an outline of another example of the refractory coating material according to the embodiment of the present invention.

Mode for Carrying out the Invention

[0009]

Hereinbelow, the embodiment of the present invention will be explained with reference to the drawings.

[0010]

Fig. 1 and Fig. 2 are cross-sectional views showing outlines of the refractory coating

materials according to the present embodiment. A refractory coating material 1 has a stacked layer structure obtained by stacking an external material layer 3 on a heat-insulating material layer 2.

[0011]

5 The heat-insulating material layer 2 is composed of a flame-retardant fibrous material. For example, rock wool felt, ceramic fiber felt or the like can be used.

As for the chemical composition of the rock wool felt, the rock wool felt comprises:

SiO₂: 30 to 55 wt%, preferably 35 to 45 wt%, CaO: 10 to 35 wt%, preferably 15 to 32 wt%,
Al₂O₃: 5 to 25 wt%, preferably 10 to 22 wt%, MgO: 3 to 15 wt%, preferably 5 to 12 wt%, FeO: 3
10 to 15 wt%, preferably 4 to 12 wt%. It is preferred that the total content of these components be 90 wt% or more, preferably 93 wt% or more.

[0012]

Such rock wool felt can be produced as follows: blast furnace slag, converter slag, basalt, amphibole, diabase, silica rock, dolomite, pyrophyllite, feldspar, pottery stone or the like
15 are blended to have the above-mentioned chemical composition, the resulting mixture is heated and molten in a cupola furnace, and the molten product is allowed to be fibrous by an arbitrary method such as a rotor method. Subsequently, fibers are collected while blowing a binder (e.g. a phenol resin or the like), and stacked in the form of a mat, followed by heating to allow the binder to be cured. It is preferred that the fibers be formed in a felt-like form having a bulk
20 density of about 70 to 130 kg/m³ and a thickness of about 20 to 65 mm.

[0013]

A refractory coating material 1 in this embodiment is obtained by stacking an external material layer 3 on the heat-insulating material layer 2 composed of such a flame-retardant fibrous material. The external material layer 3 at least includes a metal foil layer 5. In the
25 examples shown in Fig. 1 and Fig. 2, it has a three-layer structure of a thermoplastic resin film layer 4, a metal foil layer 5 and a non-woven fabric layer 6.

[0014]

In the thermoplastic resin film layer 4, a film made of a thermoplastic resin such as polyethylene, polypropylene, vinyl polychloride, vinylidene polychloride, polyethylene
30 terephthalate, an ethylene-vinyl alcohol copolymer, polyvinyl alcohol, polyamide, polyacryl, ionomer, cellulose, an ethylene-vinyl acetate copolymer, an ethylene-methacrylic acid copolymer, polystyrene or the like can be used. It is preferred that the film used in the thermoplastic resin film layer 4 have a thickness of 8 to 18 μm. Such film is preferably not only flexible but also have high toughness and is not torn easily.

35 [0015]

In the metal foil layer 5, metal foil obtained by extending a metal such as aluminum in a thickness of 5 to 10 μm can be used. By configuring the external material layer 3 to include such metal foil layer 5, it is possible to impart the refractory coating material 1 with various functions such as non-permeability to fine particles, non-permeability to gases, or the like.

5 In addition, for the non-woven fabric layer 6, a non-woven fabric such as a polyester-made, polyethylene-made or polypropylene-made non-woven fabric can be used. The basis weight thereof is preferably 10 to 50 g/m^2 .

[0016]

10 In order to stack the external material layer 3 on the heat-insulating material layer 2, each of the thermoplastic resin film layer 4, the metal foil layer 5, and the non-woven fabric layer 6 may be stacked sequentially one by one. In respect of productivity, it is preferable to prepare a stacked sheet obtained by stacking these layers by a known laminating technology, followed by stacking this stacked sheet by adhering it to the heat-insulating material layer 2. When stacking by adhering the stacked sheet to the heat-insulating material layer 2, the
15 non-woven fabric layer 6 may be opposed to the heat-insulating material layer 2 such that the refractory coating material 1 may have a stacked layer structure in which the thermoplastic resin film layer 4, the metal foil layer 5, the non-woven fabric layer 6 and the heat-insulating material layer 2 are stacked in this sequence from the surface (see Fig. 1). Alternatively, the thermoplastic resin film layer 4 may be opposed to the heat-insulating material layer 2 such that
20 the refractory coating material 1 has a stacked layer structure in which the non-woven fabric layer 6, the metal foil layer 5, the thermoplastic resin film layer 4 and the heat-insulating material layer 2 are stacked in this sequence from the surface (see Fig. 2).

[0017]

25 In this embodiment, the external material layer 3 to be stacked on the heat-insulating material layer 2 is subjected to an irregularity-imparting processing. As a result, on the surface of the external material layer 3, irregularity formed by the irregularity-imparting processing is formed in a regular or irregular pattern. As the irregularity-imparting processing, embossing processing, creasing processing, surface texture processing, satin processing or the like can be given.

30 For the convenience of drawing, the shape of the irregularity is not shown in Fig. 1 and Fig. 2.

[0018]

35 As for the irregularity formed by the irregularity-imparting processing, between the adjacent concave part and convex part, an average height difference between the deepest part of the concave part and the highest part of the convex part is preferably 0.01 to 0.5 mm, more preferably 0.01 to 0.2 mm.

[0019]

At least the metal foil layer 5 may only be subjected to the irregularity-imparting processing. Taking into consideration the handling properties at the time of processing, it is preferred that the stacked sheet in which the external material layer 3 is to be formed be subjected to the irregularity-imparting processing first, and the thus-processed sheet be then stacked on the heat-insulating material layer 2. When the stacked sheet in which the external material layer 3 is to be formed is subjected to an irregularity-imparting processing, the length of the stacked sheet along an arbitrary direction thereof is shrunk preferably by 0.05 to 1.0%, more preferably by 0.1 to 0.3% as compared with a state before subjecting to the irregularity-imparting processing.

[0020]

In the case where the metal foil layer 5 is included in the external material layer 3 in order to obtain the refractory coating material 1 with which various functions such as non-permeability to fine particles, non-permeability to gases, or the like are imparted, by subjecting the metal foil layer to an irregularity-imparting processing, when the refractory coating material 1 is wound in the form of a roll for transportation and storage or wound around steel frame materials such as an H-steel at the time of construction, it is possible to prevent formation of conspicuous creases in the metal foil layer 5. Further, when winding the refractory coating material 1 such that it is bent along a front end part of a flange part of an H-steel, irregularity formed on the metal foil layer 5 is extended to prevent the metal foil layer 5 from being torn.

[0021]

In a configuration in which the refractory coating material 1 has a stacked layer structure in which the thermoplastic resin film layer 4, the metal foil layer 5, the unwoven fabric layer 6 and the heat-insulating material layer 2 are stacked in this sequence from the surface, the unwoven fabric layer 6 that is stacked such that it opposes to the heat-insulating material layer 2 suppresses vibration of a flame retardant fibrous material on the surface of the heat-insulating material layer 2, whereby release of fibers or dust from the heat-insulating material layer 2 can be prevented. In addition, due to its non-permeability to fine particles or gases, the metal foil layer 5 can also prevent fine particles or gases (organic gases released from a binder, or the like) derived from a flame-retardant fibrous material forming the heat-insulating material layer 2 from being scattered or diffused to the outside. Further, the thermoplastic resin film layer 4 stacked on the metal foil layer 5 can prevent the metal foil layer 5 from being damaged, thereby to improve workability, and prevent dew condensation caused by entrance of open air from damaged parts of the metal foil layer 5, whereby deterioration of the heat-insulating material layer 2 by moisture can be prevented.

[0022]

Hereinabove, the present invention is explained with reference to the preferable embodiment. The present invention is not restricted to the above-mentioned embodiment, and it is needless to say various modifications are possible within the scope of the present invention.

[0023]

For example, in the above-mentioned embodiment, an example is given in which the exterior material layer 3 composed of the thermoplastic resin film layer 4, the metal foil layer 5 and the non-woven fabric layer 6 is stacked on one surface of the heat-insulating material layer 2. However, the external material layer 3 may only include at least the metal foil layer 5. On the other surface of the heat-insulating material layer 2, another non-woven fabric layer may be stacked. Further, the stacked sheet may be stacked on both surfaces (back and front) of the heat-insulating material layer 2 such that the heat-insulating material layer 2 is wrapped by at least part of the stacked sheet that forms the external material layer 3. The stacked layer structure of the heat-insulating coating material according to the present invention is not restricted to the above-mentioned embodiment.

Industrial Applicability

[0024]

The present invention can be used as the refractory coating material for improving the refractoriness of a steel frame building.

Explanation of Numerical References

[0025]

1. Refractory coating material
2. Heat-insulating material layer
3. External material layer
4. Thermoplastic resin film layer
5. Metal foil layer
6. Unwoven fabric layer

CLAIMS

1. A refractory coating material formed by stacking an external material layer including at least a metal foil layer on a heat-insulating material layer composed of a flame-retardant fibrous material, wherein
at least the metal foil layer is subjected to an irregularity-imparting processing.
2. The refractory coating material according to claim 1, wherein the exterior material layer including at least the metal foil layer and a thermoplastic resin layer, the metal foil layer has a thickness of 5 to 10 μm , the thermoplastic resin layer has a thickness of 8 to 18 μm .
3. The refractory coating material according to claim 1 or 2, wherein irregularity formed by the irregularity-imparting processing has an average height difference between a concave part and a convex part of 0.01 to 0.2 mm, and formed in irregular pattern
4. The refractory coating material according to any one of claims 1 to 3, wherein a length of the metal foil layer along an arbitrary direction thereof after subjecting to the irregularity-imparting processing is shrunk by 0.05 to 1.0 % as compared with a state before subjecting to the irregularity-imparting processing.
5. The refractory coating material according to any one of claims 1 to 4, wherein the exterior material layer is formed of a stacked sheet of an unwoven fabric layer, the metal foil layer and the thermoplastic resin layer being stacked in this sequence from surface layer thereof, and the stacked sheet is stacked on the heat-insulating material layer by adhesion.
6. The refractory coating material according to any one of claims 1 to 5, wherein the flame-retardant fibrous material that forms the heat-insulating material layer is rock wool felt, and wherein the chemical composition of the rock wool felt is: 30 to 55 wt% of SiO_2 , 10 to 35 wt% of CaO , 5 to 25 wt% of Al_2O_3 , 3 to 15 wt% of MgO and 3 to 15 wt% of FeO , with a total content of these components being 90 wt% or more.