

【DESCRIPTION】

【Invention Title】

HIGH STRENGTH REFRACTORY CONCRETE INTEGRATED FIRE
PROOFING STEEL GIRDER AND FIRE PROOFING STRUCTURE
5 CONSTRUCTION METHOD USING THE SAME

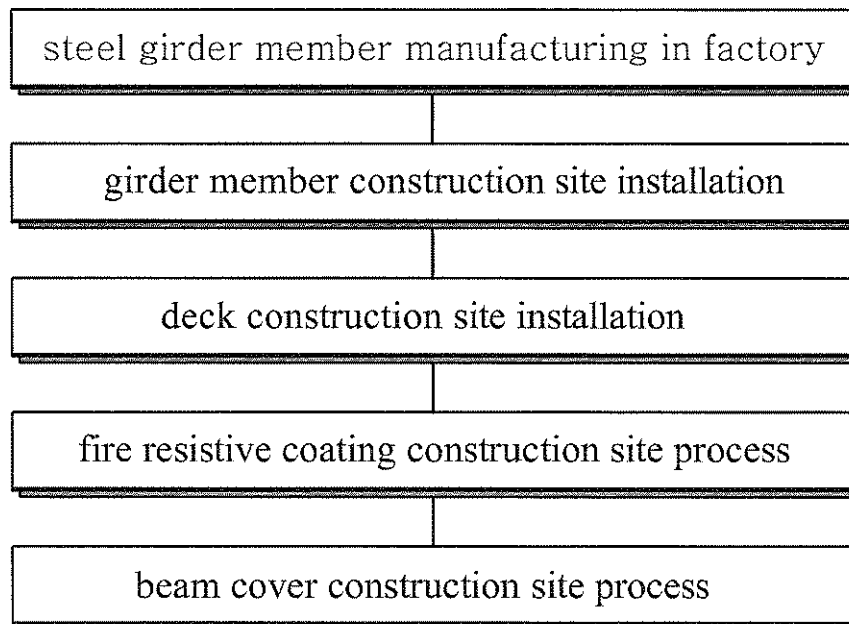
【Technical Field】

The present invention relates to a concrete integrated
fire proofing steel girder, and more particularly, to a high
strength refractory concrete integrated fire proofing steel
10 girder that does not need any separate fire resistive coating
on the construction site, thereby removing the environmental
pollution caused by fugitive dust and reducing a construction
period, and a fire proofing structure construction method
using the same.

15 【Background Art】

With the increment of the demand of high-rise buildings,
recently, steel framed buildings have been prevailed.

A construction flowchart of a conventional steel framed
system is shown as follows:



As shown above, the conventional steel framed structure necessarily needs fire resistive coating (spray application) and beam covering so as to ensure the fire resistance performance after the construction. However, the fire resistive coating shows high changes in quality in accordance with the degrees of mastery of a worker on the construction site, and if the construction is performed by a low degree of mastery of the worker, good quality of fire resistance is not achieved, which unfortunately needs the re-construction of the fire resistive coating.

Further, the fire resistive coating causes the environmental pollution by the fugitive dust generated thereby, and the fire resistive coating and the beam covering are not conducted together with other processes, thereby increasing the construction period.

Accordingly, there is a need for the development of a construction method for performing fire resistive coating with no environmental pollution, while shortening the construction period.

20 【Disclosure】

【Technical Problem】

Accordingly, the present invention has been made in view of the above-mentioned problems occurring in the prior art, and it is an object of the present invention to provide a high strength refractory concrete integrated fire proofing steel girder and a fire proofing structure construction method using the same wherein fire resistive coating is performed integrally with the production of the steel girder, thereby removing the environmental pollution on the construction site and reducing the construction period.

It is another object of the present invention to provide a high strength refractory concrete integrated fire proofing

steel girder and a fire proofing structure construction method using the same that are capable of providing more excellent fire resistance performance than that in the conventional fire resistive coating.

5 It is still another object of the present invention to provide a high strength refractory concrete integrated fire proofing steel girder and a fire proofing structure construction method using the same that are applicable to existing construction site, without any separate change in
10 design.

【Technical Solution】

To accomplish the above objects, according to the present invention, there is provided a high strength refractory concrete integrated fire proofing steel girder
15 including: a body having an upper flange, a web and a lower flange; a plurality of studs bonded to the upper flange, the web and the lower flange; first and second wire meshes arranged around the body; high strength fire proofing concrete cast and cured around the body; and a check plate
20 cast and cured on the lower end of the body in such a manner as to surround the outer surface of the high strength fire proofing concrete, wherein the check plate serves as a mold upon manufacturing and as a tension reinforcement corresponding to the tension applied to the body after the
25 construction on site, while preventing the cracks of the high strength fire proofing concrete.

According to the present invention, the high strength fire proofing concrete is made by mixing water 173 kg/m³, cement 463 kg/m³, fly ash 52 kg/m³, fine aggregate 858 kg/m³,
30 coarse aggregate 782 kg/m³, and a chemical agent 7.21 kg/m³.

【Advantageous Effect】

The present invention provides the following advantages.

First, the high strength refractory concrete integrated fire proofing steel girder and the fire proofing structure construction method using the same are provided to conduct the fire resistive coating integrally with the production of the steel girder, thereby removing the environmental pollution on the construction site and reducing the construction period.

Second, the high strength refractory concrete integrated fire proofing steel girder and the fire proofing structure construction method using the same are capable of providing more excellent fire resistance performance than that in the conventional fire resistive coating.

Last, the high strength refractory concrete integrated fire proofing steel girder and the fire proofing structure construction method using the same are applicable to the existing construction site, without any separate change in design.

【Description of Drawings】

FIG.1 is a sectional view showing a high strength refractory concrete integrated fire proofing steel girder according to the present invention.

FIG.2 is a perspective view showing the high strength refractory concrete integrated fire proofing steel girder according to the present invention.

【Best Mode for Invention】

Hereinafter, an explanation on a high strength refractory concrete integrated fire proofing steel girder according to the present invention will be in detail given with reference to the bonded drawings.

I. High strength refractory concrete integrated fire proofing steel girder

FIG.1 is a sectional view showing a high strength refractory concrete integrated fire proofing steel girder according to the present invention, and FIG.2 is a perspective view showing the high strength refractory concrete integrated fire proofing steel girder according to the present invention.

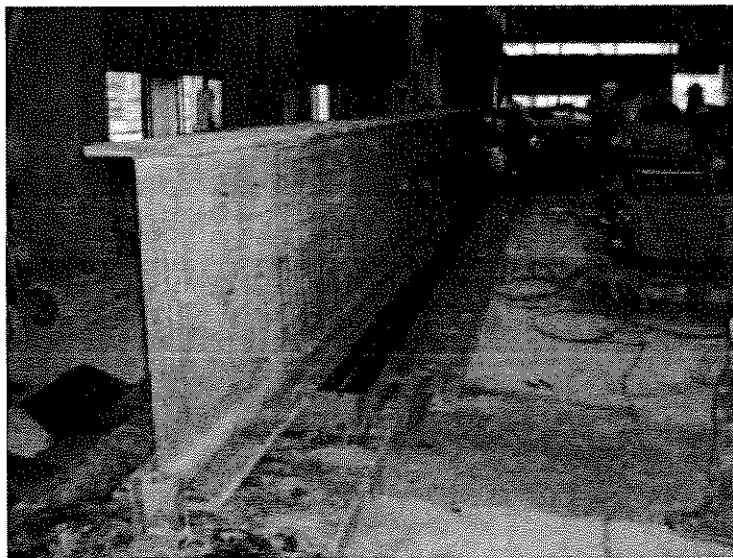
According to the present invention, there is provided a high strength refractory concrete integrated fire proofing steel girder, which is made with fire resistance performance, without any separate fire resistive coating, the steel girder including: a body 100 having an upper flange 120, a web 140 and a lower flange 160; a plurality of studs 200 bonded to the upper flange 120, the web 140 and the lower flange 160; first and second wire meshes WM1, WM2 arranged around the body 100; high strength fire proofing concrete FPM cast and cured around the body 100; and a check plate CP cast and cured on the lower end of the body 100 in such a manner as to surround the outer surface of the high strength fire proofing concrete FPM, wherein the check plate CP serves as a mold upon manufacturing and as a tension reinforcement corresponding to the tension applied to the body 100 after the construction on site, while preventing the cracks of the high strength fire proofing concrete FPM.

As shown in FIG.1, the studs 200 include: upper flange side surface studs 220 and upper flange underside surface studs 230 bonded to the side and underside surfaces of the upper flange 120; and lower flange top surface studs 250 and lower flange underside surface studs 260 bonded to the top and underside surfaces of the lower flange 160, so that the upper flange side surface studs 220, the upper flange underside surface studs 230, the lower flange top surface studs 250, and the lower flange underside surface studs 260

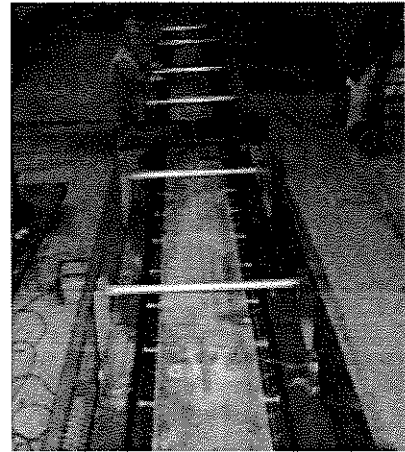
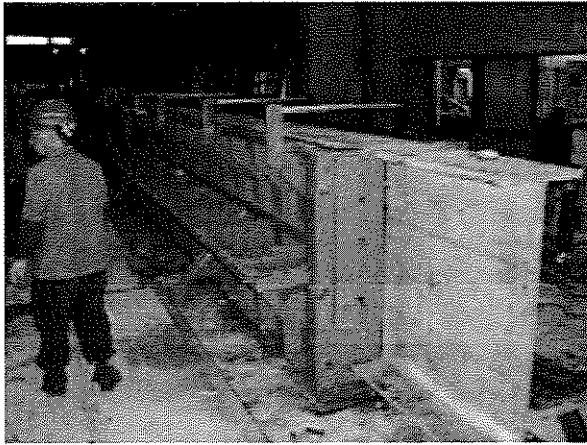
are adapted to increase the bonding force of the body 100 to the high strength fire proofing concrete FPM to correspond with a shearing force.

5 The first wire meshes WM1 are placed below the upper flange 120 of the body 100, and the second wire meshes WM2 are placed below the middle portion of the web 140 in such a manner as to be at the outside of the first wire meshes WM1. The second wire meshes WM2 serve to improve the bonding force of the high strength fire proofing concrete FPM and to
10 prevent the formation of the cracks thereon.

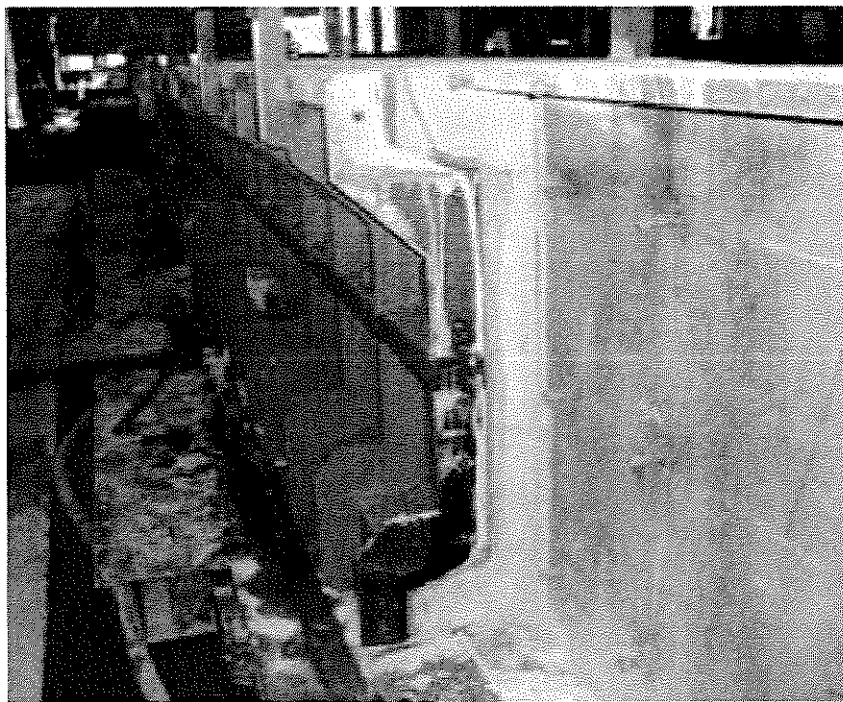
The photographs of samples for load tests are illustrated below.



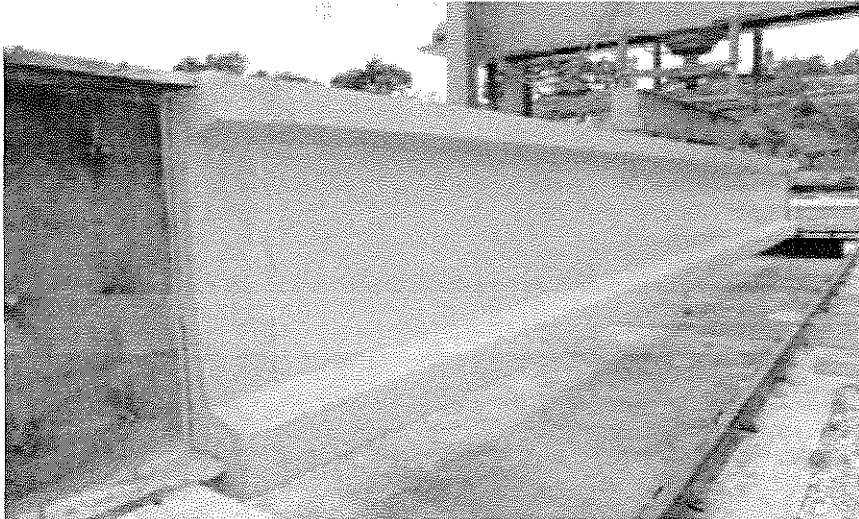
15 The just above photograph shows the studs 200 and the first and second wire meshes WM1 and WM2 bonded to the body 100.



The just above photographs show the state where a mold
is disposed before the high strength fire proofing concrete
5 FPM is cast.



The just above photograph shows the curing process after
10 the high strength fire proofing concrete FPM has been cast.



The just above photograph shows a sample of the high strength refractory concrete integrated fire proofing steel
 5 girder made for the load test.



The just above photograph shows the check plate CP.

10 Further, the high strength fire proofing concrete FPM is made by mixing water 173 kg/m³, cement 463 kg/m³, fly ash 52 kg/m³, fine aggregate 858 kg/m³, coarse aggregate 782 kg/m³, and a chemical agent 7.21 kg/m³, as listed in Table below, wherein the maximum size of the coarse aggregate is 13mm, the
 15 fine aggregate ratio is 52.9%, the water-binder ratio is

33.6%, and the chemical agent is polycarboxylate superplasticizer. The binder means the cement and the chemical agent.

W/B (%)	G _{max} (mm)	S/a (%)	quantity of material per unit (kg/m ³)					
			W	C	f/a	S	G	AD
water/ binder ratio	coarse aggregate maximum sizer	fine aggregate ratio	water	cement	fly ash	fine aggregate	coarse aggregate	chemical agent
33.6	13	52.9	173	463	52	858	782	7.21
AD = high performance polycarboxylate superplasticizer								

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According to the results (Report No. 201107164-1-1) of the fire performance test for the high strength refractory concrete integrated fire proofing steel girder, which is conducted by Korea Institute of Construction Technology, it is found that the fire performance of the high strength refractory concrete integrated fire proofing steel girder exceeds the reference value of the fire performance in the conventional practice.

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2. Fire proofing structure construction method using the high strength refractory concrete integrated fire proofing steel girder

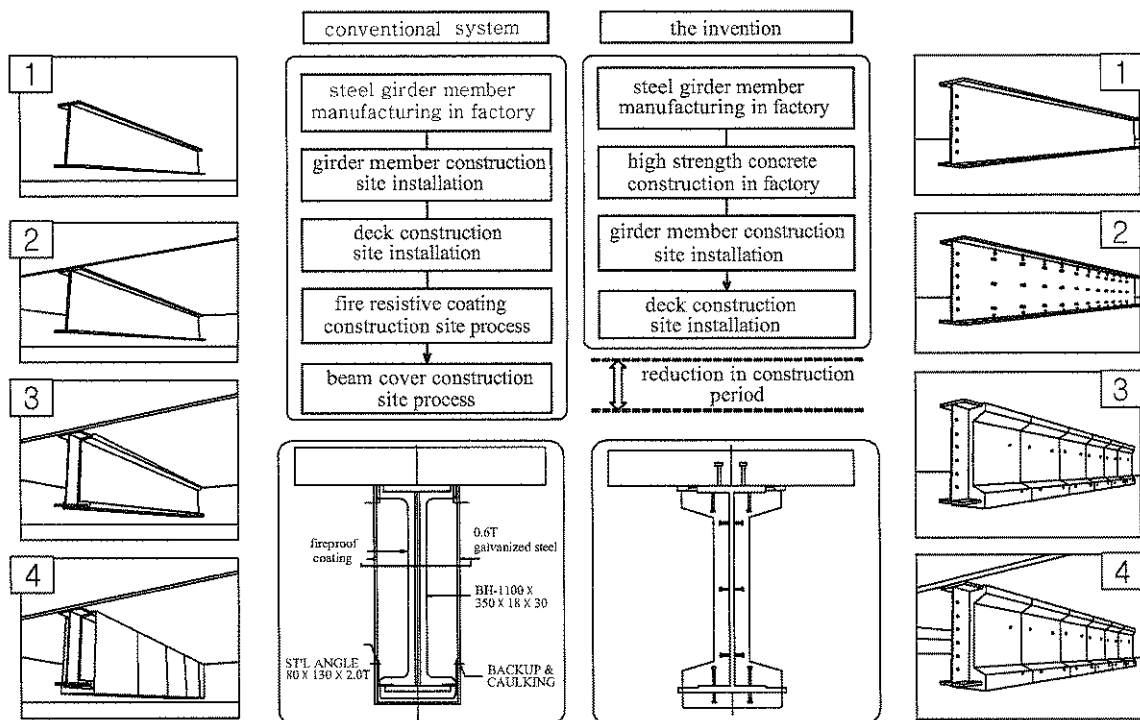
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According to the present invention, a fire proofing structure construction method using a high strength refractory concrete integrated fire proofing steel girder includes the steps of: (a) previously manufacturing the high strength refractory concrete integrated fire proofing steel girder in a factory; (b) delivering the high strength refractory concrete integrated fire proofing steel girder to a construction site and lifting and placing the steel girder;

25

(c) installing a deck plate on the top surface of the high strength refractory concrete integrated fire proofing steel girder; and (d) finishing bonding portions between the members, wherein the fire resistive coating process is removed in the construction site, thereby avoiding the generation of fugitive dust and reducing a construction period.

The conceptual comparison between the conventional steel girder construction method and the steel girder construction method of the present invention is illustrated in the following picture.



As suggested in the just above picture, the conventional steel girder construction method needs separate fire resistive coating and beam covering after the installation of the deck plate, thereby disadvantageously increasing the fugitive dust and the construction period.

According to the present invention, however, the fire resistive coating is previously performed at the time of manufacturing the steel girder, so that the fire resistive

coating and the beam covering are not separately needed on the construction site, thereby suppressing the generation of the fugitive dust and avoiding the environmental pollution on the construction site.

5 According to the present invention, in conclusion, the fire resistive coating is conducted integrally with the production of the steel girder, thereby avoiding the environmental pollution on the construction site and reducing the construction period, and the fire resistance performance
10 is more excellent than that in the conventional practice. Further, the present invention is applicable directly to the existing construction site, without any separate design change.

15 While the present invention has been described with reference to the particular illustrative embodiments, it is not to be restricted by the embodiments but only by the appended claims. It is to be appreciated that those skilled in the art can change or modify the embodiments without departing from the scope and spirit of the present invention.

【CLAIMS】**【Claim 1】**

A high strength refractory concrete integrated fire proofing steel girder, which is made with fire resistance
5 performance, without any separate fire resistive coating, the steel girder comprising:

a body 100 having an upper flange 120, a web 140 and a lower flange 160; a plurality of studs 200 bonded to the upper flange 120, the web 140 and the lower flange 160;

10 first and second wire meshes WM1, WM2 arranged around the body 100;

high strength fire proofing concrete FPM cast and cured around the body 100; and

a check plate CP cast and cured on the lower end of the
15 body 100 in such a manner as to surround the outer surface of the high strength fire proofing concrete FPM,

wherein the check plate CP serves as a mold upon manufacturing and as a tension reinforcement corresponding to the tension applied to the body 100 after the construction on
20 site, while preventing the cracks of the high strength fire proofing concrete FPM.

【Claim 2】

The high strength refractory concrete integrated fire proofing steel girder according to claim 1, wherein the studs
25 200 comprise: upper flange side surface studs 220 and upper flange underside surface studs 230 bonded to the side and underside surfaces of the upper flange 120; and lower flange top surface studs 250 and lower flange underside surface studs 260 bonded to the top and underside surfaces of the
30 lower flange 160, so that the upper flange side surface studs 220, the upper flange underside surface studs 230, the lower flange top surface studs 250, and the lower flange underside

surface studs 260 are adapted to increase the bonding force of the body 100 to the high strength fire proofing concrete FPM to correspond with a shearing force.

【Claim 3】

5 The high strength refractory concrete integrated fire proofing steel girder according to claim 1 or 2, wherein the first wire meshes WM1 are placed below the upper flange 120 of the body 100, and the second wire meshes WM2 are placed below the middle portion of the web 140 in such a manner as
10 to be at the outside of the first wire meshes WM1, the second wire meshes WM2 serving to improve the attaching force of the high strength fire proofing concrete FPM and to prevent the formation of the cracks thereon.

【Claim 4】

15 The high strength refractory concrete integrated fire proofing steel girder according to claim 1 or 2, wherein the high strength fire proofing concrete FPM is made by mixing water 173 kg/m³, cement 463 kg/m³, fly ash 52 kg/m³, fine aggregate 858 kg/m³, coarse aggregate 782 kg/m³, and a
20 chemical agent 7.21 kg/m³.

【Claim 5】

 The high strength refractory concrete integrated fire proofing steel girder according to claim 3, wherein the high strength fire proofing concrete FPM is made by mixing water
25 173 kg/m³, cement 463 kg/m³, fly ash 52 kg/m³, fine aggregate 858 kg/m³, coarse aggregate 782 kg/m³, and a chemical agent 7.21 kg/m³.

【Claim 6】

 The high strength refractory concrete integrated fire
30 proofing steel girder according to claim 1 or 2, wherein the high strength fire proofing concrete FPM has the coarse aggregate maximum size of 13mm, the fine aggregate ratio of

52.9%, and the water-binder ratio of 33.6%, and the chemical agent is polycarboxylate superplasticizer.

【Claim 7】

The high strength refractory concrete integrated fire proofing steel girder according to claim 3, wherein the high strength fire proofing concrete FPM has the coarse aggregate maximum size of 13mm, the fine aggregate ratio of 52.9%, and the water-binder ratio of 33.6%, and the chemical agent is polycarboxylate superplasticizer.

10 【Claim 8】

The high strength refractory concrete integrated fire proofing steel girder according to claim 4, wherein the high strength fire proofing concrete FPM has the coarse aggregate maximum size of 13mm, the fine aggregate ratio of 52.9%, and the water-binder ratio of 33.6%, and the chemical agent is polycarboxylate superplasticizer.

【Claim 9】

The high strength refractory concrete integrated fire proofing steel girder according to claim 5, wherein the high strength fire proofing concrete FPM has the coarse aggregate maximum size of 13mm, the fine aggregate ratio of 52.9%, and the water-binder ratio of 33.6%, and the chemical agent is polycarboxylate superplasticizer.

【Claim 10】

25 A fire proofing structure construction method using the high strength refractory concrete integrated fire proofing steel girder according to claim 1 or 2, the method comprising the steps of:

(a) previously manufacturing the high strength refractory concrete integrated fire proofing steel girder in a factory;

(b) delivering the high strength refractory concrete integrated fire proofing steel girder to a construction site and lifting and placing the steel girder;

5 (c) installing a deck plate on the top surface of the high strength refractory concrete integrated fire proofing steel girder; and

(d) finishing the bonding portions between the members, wherein a fire resistive coating process is removed on the construction site, thereby avoiding the generation of fugitive dust and reducing a construction period.

【Claim 11】

A fire proofing structure construction method using the high strength refractory concrete integrated fire proofing steel girder according to claim 3, the method comprising the

15 steps of:

(a) previously manufacturing the high strength refractory concrete integrated fire proofing steel girder in a factory;

(b) delivering the high strength refractory concrete integrated fire proofing steel girder to a construction site and lifting and placing the steel girder;

(c) installing a deck plate on the top surface of the high strength refractory concrete integrated fire proofing steel girder; and

25 (d) finishing the bonding portions between the members, wherein a fire resistive coating process is removed on the construction site, thereby avoiding the generation of fugitive dust and reducing a construction period.

【Claim 12】

30 A fire proofing structure construction method using a high strength refractory concrete integrated fire proofing

steel girder according to claim 4, the method comprising the steps of:

- 5 (a) previously manufacturing the high strength refractory concrete integrated fire proofing steel girder in a factory;
- (b) delivering the high strength refractory concrete integrated fire proofing steel girder to a construction site and lifting and placing the steel girder;
- 10 (c) installing a deck plate on the top surface of the high strength refractory concrete integrated fire proofing steel girder; and
- (d) finishing the bonding portions between the members, wherein a fire resistive coating process is removed on the construction site, thereby avoiding the generation of
15 fugitive dust and reducing a construction period.