Super heat resistance Ceramic Coating
Cosmo-Coat327

Patented ; Japan

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What is Cosmo-Coat;

Cosmo Coat consist of alkali metal silicate compounds and several inorganic powders of heat resistance aggregate such as Alumina, Zirconium oxide, Silicon dioxide and catalyst of which can melt inorganic aggregate surface below temperature of base metal soften point (900~1000℃) ,and to form oxidation resistance metal-ceramic membrane on the surface of base metal.

This new material is capable to follow between the different expansion materials even at high temperature and to stand thermal shocks too.

Cosmo Coat membrane are formed different size of particle aggregate and absolved expansion ratio which dose not be cracked, removed even quenching from high temperature This membrane formed so called functional materials on the base metal interfacial and gives good performance against under high temperature oxygen an atmosphere .

In case of refractory, formed glass like membrane of the surface of refractory about 950℃ and prevent penetration high temperature gas into refractory inside. This may protect spalling of refractory and also performs delayed adhere the clinker to the furnace wall.

Cosmo Coat gives easy maintenance of furnace and giving long life of refractory, also possibly extended life of the furnaces.

Cosmo Coat is unique products which may necessary for environment and save cost.

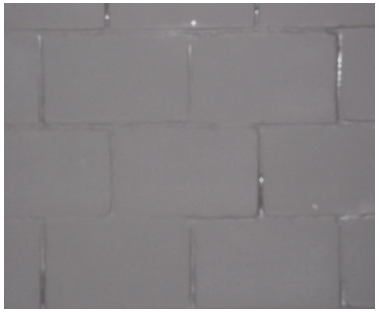
We believe that Cosmo Coat is very helpful products not only enterprise but also municipality.

Purpose of development;

1. Added valued to Steel and stainless steel to be applied under high temperature atmosphere.

* Possible to use under high temperature as the same level as Nickel alloy.
* Save energy and increase efficiency.
* Usage of limited temperature increase for the Nickel alloy.

2. Protect refractory and save energy (Increase emissivity)



* Protection from heat spaling of furnace refractory wall. (Protecting form refractory fall down., reduce refractory thickness)
* Shorten the maintenance times due to delayed clinker adhere to the refractory wall.
* Thermal efficiency improved for Refinery and chemical plant process furnace.(Protect from oxidation of Radiant section pipe and increase furnace wall surface emissivity.
* Extended life of heating furnaces .

Characteristic of Products;

1. **Possibly usage of temperature up to 900~1,100℃with steel , stainless steel.**
2. **No cracked, removed of ceramic coated membrane even quenching (strong against thermal shock)**
3. **Kind to environment (No harmful materials used)**
4. **Application circumstance is quite good。**
5. **Cost reduction with save energy and improvement of efficiency.**
6. **Possible to serve colored Cosmo Coat(limited temperature to use up to 700℃)**

Application;

1. ***For Fire Bricks, Castable refractory***

Incinerator, Sintering furnace, Eclectic Oven、refinery, chemical plant process furnace , boiler and other heating furnaces for protection of furnace wall and increased emissivity.

(Protected form Heat spalling, Clinker adhere ,refractor wall fall down etc)

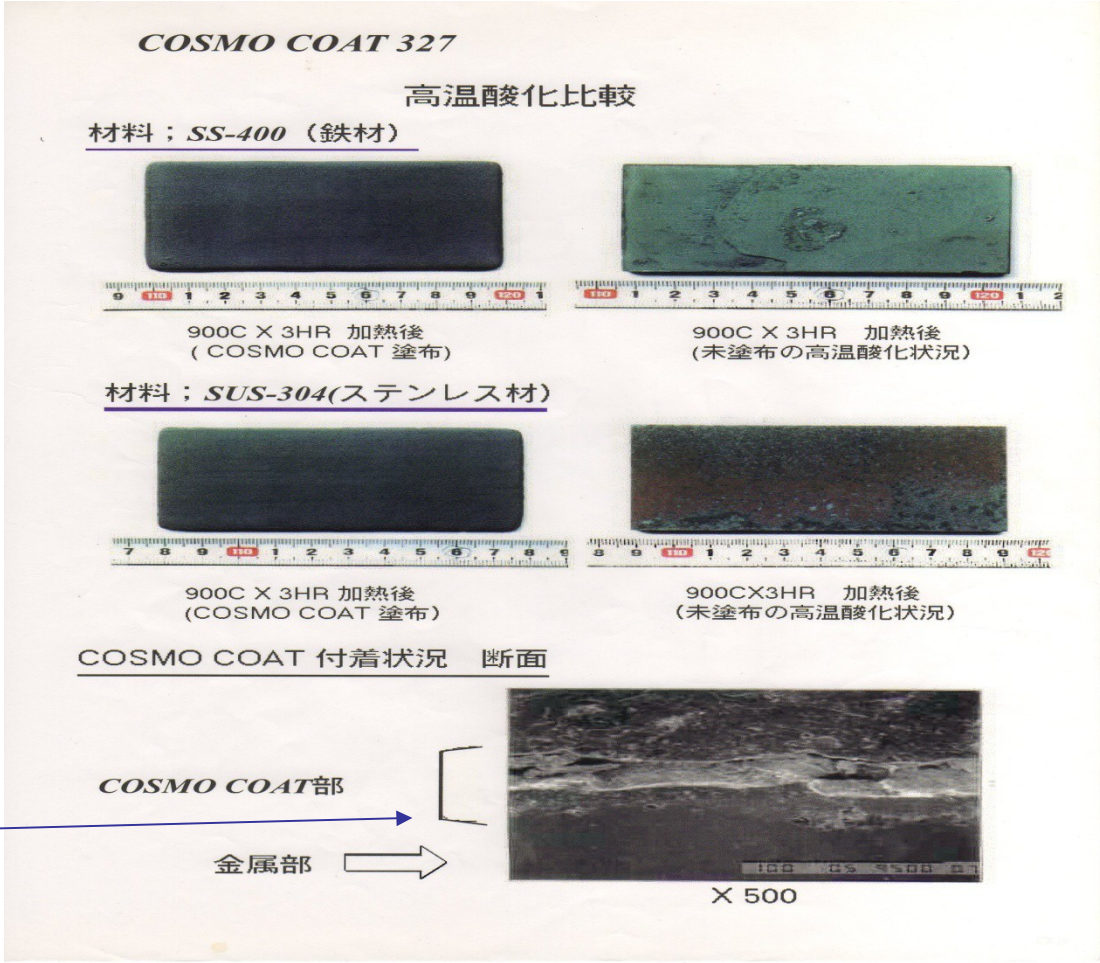
2. ***For Metal ;***

* **Protection from high temperature oxidation of Steel, Stainless steel such as refinery, chemical plant process furnace, boiler, heat exchanger etc.**
* **Protected from Reflection heat to Burner, nozzle and metal cover etc.**
* **Protection from oxidation of electric heater and far infrared effecting**
* **Lining for heat exchange of large scale boiler elements.**
* **All kind of steel, stainless steel, nickel alloy, steel alloy used under high temperature atmosphere applications.**

Testing Cosmo Coat oxidation at 900℃ with 3hrs

At SUMIKIN TECHNOLOGY

Compared Coated and non Coated Steel and SUS After 900℃, 3Hr Sintering. Coated metals Were no Oxidation, No cracked and no Removed membrane.

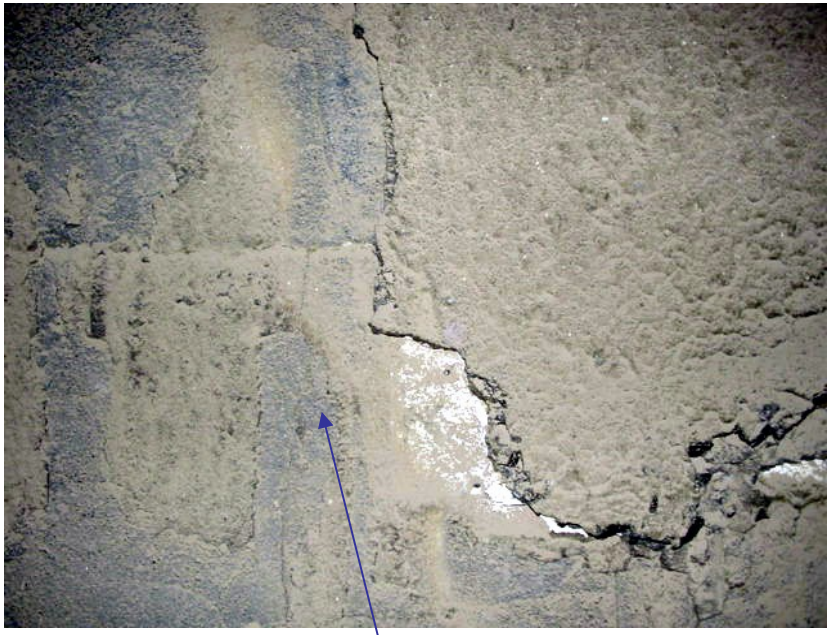


Interfacial metal

At；Mie-Chuo kaihatsu（Industrial disposal Incinerator）

Rotary kiln /stoker combined 75tons/day capacity.
Mitsubishi-Heavy Ind. made

- **Operated 60days and checked clinker adhere, spalling .**
- **Before Cosmo Coat coated** **After 60 days operated**



＊Below Rotary kiln where is a part of high temperature.
＊No spalling and No clinker adhered on castable wall.

At；SANIX Kita-Kyushu Plant（**Industrial disposal Incinerator**）

Rotary kiln /stoker combined 150tons/day capacity.
TAKUMA. made

- **Operated 90days and checked clinker adhere, spalling .**

Clinker adhered only 20cm on the wall **Ceiling part has almost no**

Usually, flue part has stricture by clinker and reduced burning capacity remarkably. After coated clinker can be removed by hand easily.

I City Incinerator (45ton/16Hrs Capacity)

(Stoker incinerator)

Left；Coating work　　Right；After operated, clinker fall down automatically.

T City Incinerator (Stoker Incinerator)

(Stoker ;Heat resistance casting iron)

Steel wire sintering pot（TOHO-SHODON）

Left；Coating to the sintering pot　　右；Steel wire sintering pot

Evaluation at Kyushu-Kyouritsu Univ.Lab.

- **Evaluation test at Kyushu-Kyoritsu Univ.**

第４回耐熱塗料試験結果

九州共立大学　総合研究所　渡辺

＜試験片＞

SUS430　４ピース（全面塗布）

SS400　４ピース（全面塗布）

＜試験方法＞

各テストピースを室温にて投入、炉内温度 1000℃間で昇温（２時間 40 分）

1000℃到達後 1000℃を保ちつつ１時間置きに各１枚を取り出し室温にて急冷させた。

＜測定＞

各テストピースにおいて、加熱前後の重量及び厚さの変化を測定し、酸化による部材の劣化具合をテストした。

測定結果について

＜加熱による重量変化測定＞

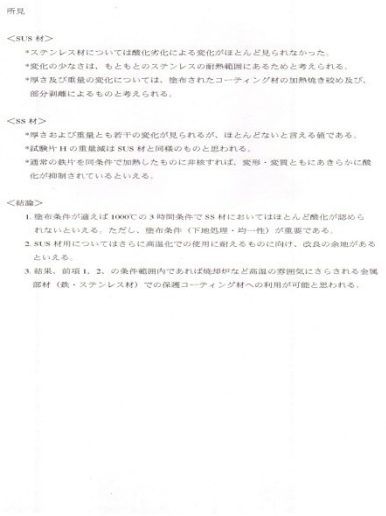
SUS	加熱放置時間	加熱前重量	加熱後重量	増減値
試験片 A	3 時間	33.406	33.124	-0.282
試験片 B	3 時間	33.076	32.874	-0.202
試験片 C	2 時間	33.336	33.166	-0.170
試験片 D	1 時間	33.402	33.277	-0.125

SS	加熱放置時間	加熱前重量	加熱後重量	増減値
試験片 E	3 時間	52.116	52.199	+0.083
試験片 F	3 時間	51.680	51.686	+0.006
試験片 G	2 時間	52.560	52.526	-0.034
試験片 H	1 時間	51.682	51.646	-0.036

＜加熱による板厚変化測定＞

SUS 材については変化が見られないため測定を省略した。

SS	加熱放置時間	加熱前重量	加熱後重量	増減値
試験片 E	3 時間	4.59	4.86	+0.27
試験片 F	3 時間	4.63	4.64	+0.01
試験片 G	2 時間	4.65	4.66	+0.01
試験片 H	1 時間	4.63	4.61	-0.02



所見

＜SUS 材＞

*ステンレス材については酸化劣化による変化がほとんど見られなかった。

*変化の少なさは、もともとのステンレスの耐熱範囲にあるためと考えられる。

*厚さ及び重量の変化については、塗布されたコーティング材の加熱焼き絞め及び、部分剥離によるものと考えられる。

＜SS 材＞

*厚さおよび重量とも若干の変化が見られるが、ほとんどないと言える値である。

*試験片 H の重量減は SUS 材と同様のものと思われる。

*通常の鉄片を同条件で加熱したものに非依すれば、変形・変質ともにあきらかに酸化が抑制されているといえる。

＜結論＞

1. 塗布条件が適えば 1000℃の３時間条件で SS 材においてはほとんど酸化が認められないといえる。ただし、塗布条件（下地処理・均一性）が重要である。
2. SUS 材用についてはさらに高温化での使用に耐えるものに向け、改良の余地があるといえる。
3. 結果、前項 1、2、の条件範囲内であれば焼却炉など高温の雰囲気にさらされる金属部材（鉄・ステンレス材）での保護コーティング材への利用が可能と思われる。

- **Coated on steel, stainless steel and sintered 1～3Hrs.**
- **Checked weight loss, increase and crack, removed due to oxidation.**

Test peace making process
sintering process.

＊Test peace making for evaluation (1,000℃sintering)