

SHINAGAWA TECHNICAL REPORT

速乾性RH浸漬管補修用吹き付け材

Fast Drying Hot Gunning Repair Material
for RH Degasser Snorkels

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品川技報

製品紹介 PRODUCTS

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Fast Drying Hot Gunning Repair Material for RH Degasser Snorkels

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要 旨

粒度構成の変更と特殊添加剤の配合により従来品と同等の高温面への付着性を保ちつつ、水抜け性に優れるRH浸漬管補修用吹き付け材を開発した。

Abstract

We developed a new hot gunning repair material for RH degasser snorkels with excellent drying ability by changing the grain size composition and adding a special additive. This newly developed material maintains the same adhesion to high temperature surfaces as the conventional material.

1. はじめに

RH法は二次精錬プロセスの一つであり、上部槽と2本の浸漬管を有する下部槽からなる大型の真空槽を使用して実施される。RH浸漬管の熱間補修には計画的な補修手段として圧入補修材や応急的な補修手段として吹き付け補修材が一般的に使用される。

特に吹き付け補修材は比較的短時間での補修が可能であることから浸漬管下端部や外周部で頻繁に使用され、浸漬管の損傷が進んだ使用末期では毎チャージ補修されることもある。浸漬管はRH処理終了後、直ちに吹き付け補修され、数分から数十分の養生の後、再び溶鋼に浸漬される。そのため吹き付け時の浸漬管温度は700～900℃と高温であることが多く、吹き付け補修材には高温面への優れた付着性が求められる。また、RHの処理数

1. Introduction

The RH process is one of the secondary refining processes. It is carried out using a large vacuum chamber that consists of an upper chamber and a lower chamber with two snorkels. For hot repairs of RH degasser snorkels, injection repair material is generally used for planned repairs and gunning material is generally used for emergency repairs.

In particular, gunning material can be used in a relatively short time, so that it is frequently used at the lower part of snorkels or at the outer peripheral surface. In addition, gunning material can be used after every heat when snorkels are largely damaged. Immediately after completion of RH treatments, snorkels are

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が多い場合には吹き付け後の待機時間が短く吹き付け材の乾燥が不十分になることがある。この場合、溶鋼への浸漬時に湯沸きが発生、吹き付け材が剥離し、浸漬管の耐用性が低下する。そのため良好な水抜け性も重要な必要特性と言える。

本研究では従来材と同等の付着性を持ち、かつ水抜け性を向上させたRH浸漬管補修用吹き付け材を開発したので以下に報告する。

2. RH浸漬管補修用吹き付け材JTM-M-537

Fig.1に従来品と開発品の粒度構成を示す。開発品JTM-M-537は従来材と比較して粗粒が多く、微粉の少ない配合である。粗粒リッチな粒度構成にすることで吹き付け・養生後の組織が従来品と比較して粗になり、蒸気の抜け性が向上すると予想される。さらに、開発品JTM-M-537には高熱伝導率の特長を持つ特殊添加剤を配合している。この添加剤効果により吹き付け補修後、短時間で施工体内部にまで熱が伝わり、水抜け性が向上すると考えられる。

3. 吹き付け試験結果

従来品と開発品をそれぞれ温間で吹き付け試験し、その付着率を比較した。さらに、吹き付け後施

subjected to gunning repair, and after curing for several minutes up to close to an hour, the snorkels are immersed in molten steel again. Therefore, the temperature of snorkels at the time of gunning is as high as 700 °C to 900 °C in many cases. For this reason, excellent adhesion to the high temperature surface is required for gunning material. When RH treatments are on a tight schedule, curing time after gunning may be short, and the gunning material may be insufficiently dried. In this case, boiling occurs during immersion in the molten steel and the gunning material peels off. Thereby the durability of the snorkels decreases. Therefore, high drying ability is also an important property.

In this study, we'll report on a new gunning material for repairing RH degasser snorkels, which has the same adhesion as that of the conventional material and improved drying ability.

2. Gunning Material JTM-M-537 for Repairing RH Degasser Snorkels

Fig.1 shows the grain size composition of the conventional material and the developed material. Developed material JTM-M-537 has more coarse grains and less fine powder than the conventional material. Since there will be many coarse grains in the repaired body, it can be expected that the drying property will be improved in actual use. In addition, a special additive with high thermal conductivity was added to developed material JTM-M-537. The additive effect is considered to be that heat is transferred to the inside of the repaired body in a shorter time after gunning and curing, and drying ability is improved.

3. The Results of Gunning Test

The conventional material and the developed material were each tested for gunning on a high temperature surface and the adhesion rates

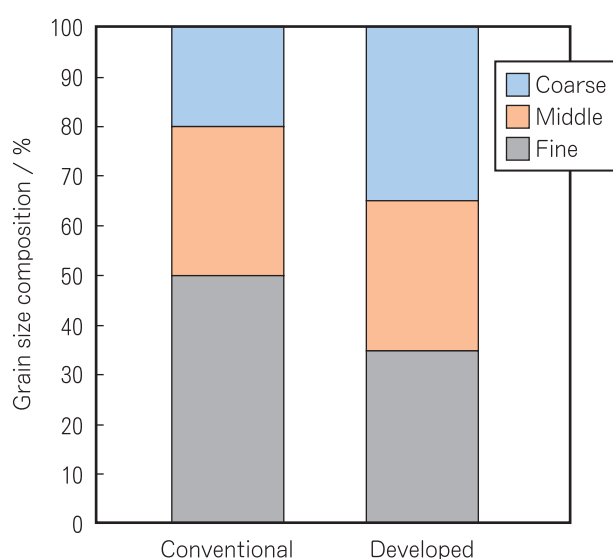


Fig. 1 Grain size composition.

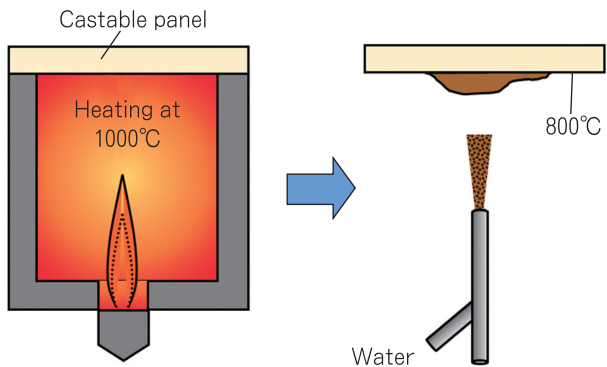


Fig. 2 Schematic diagram of gunning test.

	Conventional	Developed
Appearance		
Water content / %	17.5	16.0
Adhesion rate / %	88	86

Fig. 3 After gunning test.

工体表面の温度測定により水抜け性を評価した。Fig.2に試験方法を示す。予めバーナーで1000℃に加熱しておいたキャストブルパネルを炉外で放冷し、800℃になったところで吹き付け試験を実施した。吹き付けた従来品、開発品の表面温度をそれぞれサーモカメラで測定し、水抜け性の確認を行った。

Fig.3に吹き付け試験結果を示す。開発品は従来品とほぼ同等の付着率を示した。また、吹き付け時のポッピング（水蒸気による表層剥離）もなく、吹き付け後の施工体はしっかりしていた。以上の結果より、実機施工においてもRH処理終了後の浸漬管表面で良好に吹き付け補修が可能であると考えられる。また、開発品は従来品と比較して添加水量が少ないため作業時の湯沸き対策にもつながると考えられる。

were compared. In addition, the drying ability was evaluated by temperature measurement of the surface of the repaired body after gunning. Fig.2 shows the gunning testing method. The castable panel was previously heated to 1000℃ by a burner. This panel was taken out of the furnace, and the gunning test was carried out when the temperature reached 800℃. The surface temperatures of the gunned conventional and developed materials were measured by thermography camera and drying abilities were confirmed.

Fig.3 shows the gunning test results. The developed material showed almost the same adhesion rate as the conventional material. In addition, there was no peeling of the surface layer by water vapor at the time of gunning and the repaired body was stiff after gunning. From the above, it is considered that the gunning material can be installed on the surface of snorkels after the completion of the RH treatment even in actual use. Furthermore, since the amount of the water addition of the developed material is less than that of the conventional material, it is considered that the developed material will also be an effective measure against boiling during operation.

Fig.4 shows the measurement results of the thermography carried out five minutes after gunning. It can be seen that the developed material has a faster rise in surface temperature after gunning and high drying ability compared with the conventional material. In actual repairing of the RH degasser snorkels, drying in a short time after gunning is considered to be possible. Therefore, even when the curing time after gunning repair is shorter than that of the conventional material, immersing in molten steel becomes possible. It can be expected that the operation rate of the RH treatment is improved.

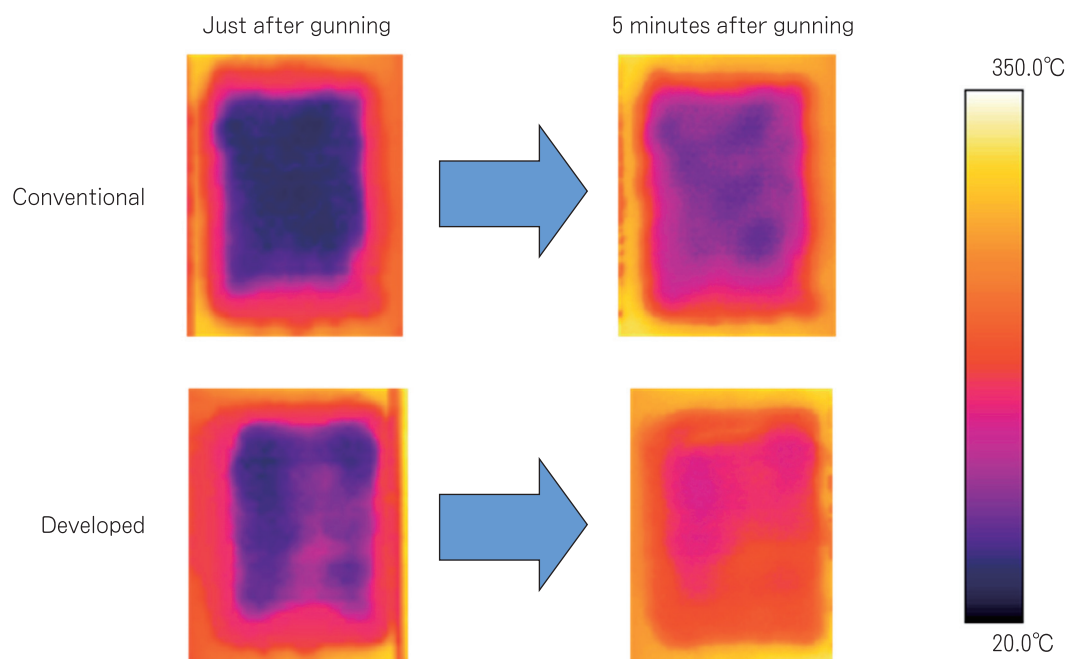


Fig. 4 Surface temperature measured by thermography camera.

Fig.4に吹き付け直後および5分養生後のサーモカメラ測定結果を示す。開発品は従来品と比較して施工後の表面温度上昇が早く乾燥性が良好、すなわち水抜け性に優れていることがわかる。実際の浸漬管補修においても施工後、短時間での乾燥が可能と考えられるため吹き付け補修後の養生時間が従来品よりも短い場合にも溶鋼浸漬が可能となり、RHの稼働率向上に繋がると期待できる。

4. まとめ

粒度構成の変更と特殊添加剤の配合により従来品と同等の高温面への付着性を保ちつつ、優れた水抜け性を持つRH浸漬管補修用吹き付け材を新たに開発した。既に実機にて評価中であり、高評価を頂いている。今後は更に改良を加え各所に応用していく所存である。

4. Conclusion

We developed a new hot gunning repair material for RH degasser snorkels with excellent drying ability. It was designed to maintain the same adhesion to a high temperature surface as the conventional material by changing the grain size composition and adding special additives. It has already been used on actual machines and is performing well. We intend to improve this material and apply it at many steel companies throughout Japan.