

発熱材HOTMEL（ホットメル）シリーズ

HOTMEL, a New Series of Exothermic Materials

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Abstract

A new series of intense exothermic materials called “HOTMEL” has been developed. Its functions are mainly dissolving slag and raising molten steel temperature. It has been used for blast furnace troughs and tundishes.

1. はじめに

ノロ溶解，溶鋼温度上昇などを目的とした強力な発熱材「HOTMEL」シリーズを開発しました。HOTMELは700℃以上に加熱されると発熱を開始し，短時間に強発熱してHOTMEL自身は2000℃以上まで温度上昇します。HOTMELの発熱システムは金属（還元材）と酸化材の酸化発熱反応を利用したものであり不活性ガス雰囲気下でも発熱します。化学成分は主に金属シリコンと酸化鉄からなり，①式の反応により発熱反応後はシリカと金属の鉄になります。



2. 特 徴

- (1) 短時間で強力に発熱する
- (2) 発熱中の白煙が少ない(発熱中の白煙発生を抑制し，作業環境の悪化が少ない)
- (3) 反応後，スラグが固化しにくい（タンディッシュでの使用も考慮し，発熱後においてもスラグ流動性を保つことができる）

3. 実 験

3. 1 発熱状況

高周波誘導炉で1500℃の溶銑上にHOTMELを投入し

1. Introduction

A new series of intense exothermic materials called “HOTMEL” has been developed. Its functions are dissolving slag, raising molten steel temperature, and so on. HOTMEL begins its exothermic reaction when it is heated to over 700℃. And the exothermic reaction becomes intense in a short time. Its temperature rises to over 2000℃. The exothermic system of HOTMEL is a reaction between metals and oxides. In addition, the exothermic reaction is generatable under inert gas atmosphere because it contains oxides. HOTMEL mainly consists of metallic silicon and iron oxide. And after the exothermic reaction, it becomes metal iron and silica through the reaction in equation (1)



2. Characteristics

- (1) Exothermic reaction becomes intense in a short time.
- (2) Little white smoke occurs during the exothermic reaction. (Little degradation of working environment)
- (3) Slag remains soft after the exothermic reaction.

3. Experiment

3. 1 The exothermic state

HOTMEL is shown in an exothermic state in Fig.1. HOTMEL was put on 1500℃ molten steel in a high frequency induction furnace. The exothermic reaction started after approximately 7sec. An intense exothermic reaction continued for approximately 15sec. After the reaction, it became fluid slag, generating little smoke while testing.

Table 1 Typical Properties

	HOTMEL-1	HOTMEL-2
Chemical compositions (Change to oxide value)		
SiO ₂	40mass%	46mass%
Fe ₂ O ₃	68mass%	67mass%
Amount of metal	21mass%	21mass%
Start time of exothermic reaction at 1000℃	12sec	8sec
—100mesh screen	<3mass%	<3mass%

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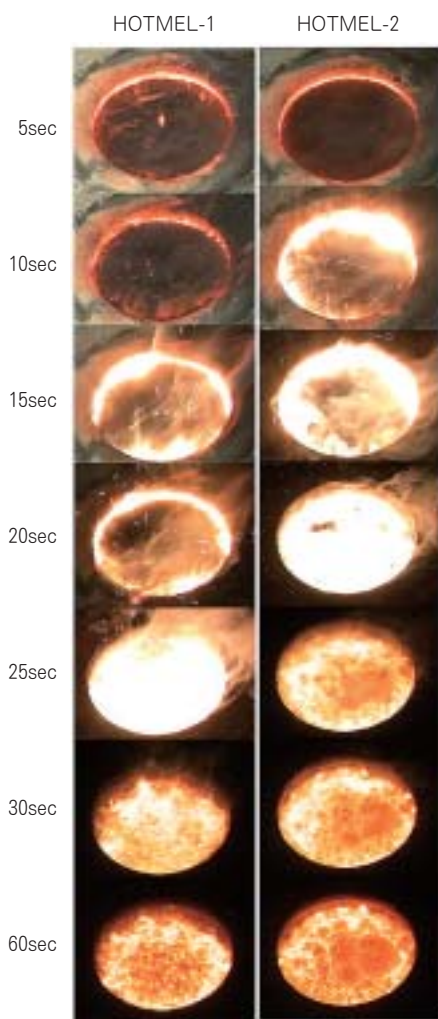


Fig. 1 Exothermic state of HOTMEL.

た時の発熱状況をFig. 1 に示す。HOTMELを投入後約7秒で発熱が開始し、激しい発熱反応が約15秒間続いた。発熱反応終了後は熔融スラグとなった。なお、発熱中の白煙発生量は少なかった。熔融後のスラグは凝固することなく流動性を保っていた。

3. 2 発熱量

実験装置をFig. 2 に示す。1000℃に保持した電気炉中に、重量約10gのルツボを予めセットしておく。10gの室温のサンプルをルツボに投入し、ルツボ底にセットした熱電対によりルツボへの伝熱を測定した。

実験結果をFig. 3 に示す。なお、比較としてHOTMELの主成分である酸化鉄についても測定した。サンプル投入時に電気炉を下降させルツボが炉外に出るためルツボ温度が一時的に低下するが、HOTMELは投入後約10秒で発熱開始し、強発熱によって坩堝の温度が瞬時に1300℃以上まで上昇した。

4. 用途例

- (1) 溶鉄樋…湯溜部のノロ溶解、温度補償
- (2) タンディッシュ…鑄造開始時や鍋交換時の溶鋼温度上昇
- (3) 転炉補修…焼付補修時の熱供給

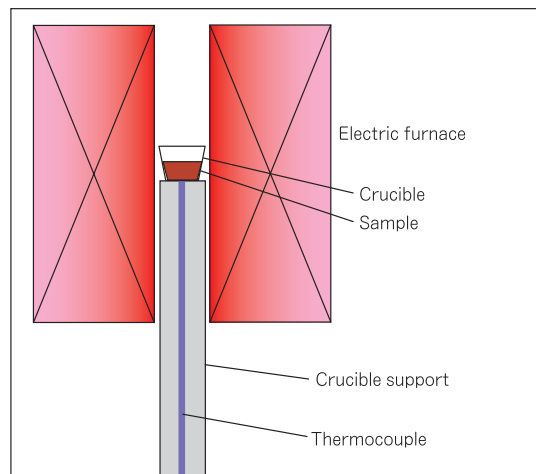


Fig. 2 Equipment for testing exothermic reaction.

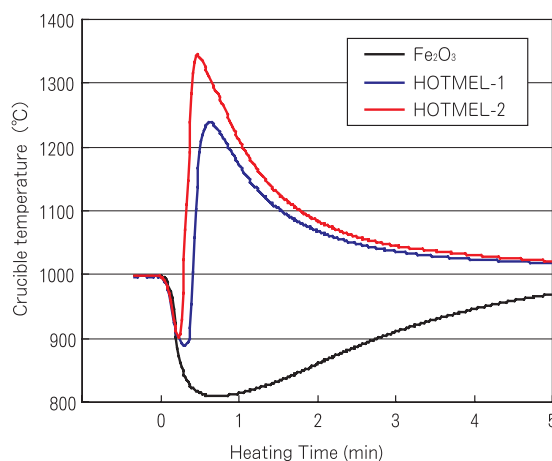


Fig. 3 Experimental results for exothermic reaction.

3. 2 Measurement of calorific value

The experiment equipment is shown in Fig.2. An approximately 10g crucible was set beforehand in an electric furnace and heated to 1000℃. A 10g sample was put in the crucible. Heat transfer to the crucible was measured with a thermocouple set under the crucible.

The experimental results are shown in Fig.3. Because the crucible came out of the furnace when the sample was put in, crucible temperature declined temporarily.

The exothermic reaction started after approximately 10sec when the sample was put in the furnace, and crucible temperature rose to over 1300℃ for a moment with the intense exothermic reaction.

4. Usage Example

- (1) Blast furnace trough: dissolution of slag
- (2) Tundish: The temperature of the molten steel rose at casting start and before ladle exchanging
- (3) Hot repairs of converter: Provides heat supply during repair