

# Desulfurizing Agents for Dry Processes for Removing CS<sub>2</sub> and COS\*

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## 1 Introduction

The sulfur contained in coke oven gas is mainly hydrogen sulfide (H<sub>2</sub>S) of inorganic sulfur compounds, but carbon disulfide (CS<sub>2</sub>) and carbonyl sulfide (COS) of organic sulfur compounds also exist. Kawasaki Steel has developed a CS<sub>2</sub> desulfurizing agent<sup>1)</sup>, COS desulfurizing agent<sup>2)</sup>, and H<sub>2</sub>S desulfurizing agent<sup>3)</sup> with the aim of removing the sulfur compounds under room temperature and normal atmospheric pressure conditions by dry processes. Since the desulfurizing agent for H<sub>2</sub>S has already been introduced,<sup>4)</sup> this report introduces the desulfurizing agents for CS<sub>2</sub> and COS together with their features, purposes, performances, etc.

## 2 Specifications and Outstanding Features

### 2.1 Specifications

The specifications of the desulfurizing agents for CS<sub>2</sub> and COS are shown in Table 1. The desulfurizing agent for CS<sub>2</sub> is a spherical adsorbent made by impregnating secondary amine in calcium silicate. The desulfurizing

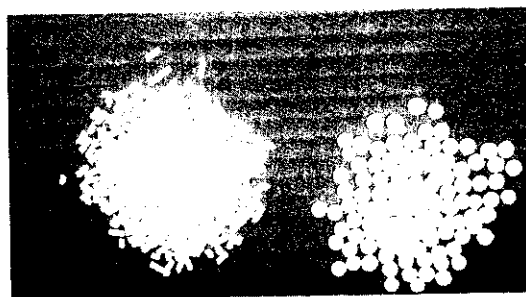


Photo 1 Appearance of desulfurizing agents for removing COS and CS<sub>2</sub>

agent for COS is a column-shaped hydrolytic catalyzer made by an impregnating alkaline metallic compound in alumina.

The diameter, length, hardness, etc., of the desulfurizing agent can be adjusted properly, and application to various packed beds is possible. Photo 1 shows examples of the appearance of the CS<sub>2</sub> and COS desulfurizing agents.

Table 1 Specification of each desulfurizing agent for removing CS<sub>2</sub> and COS

	CS <sub>2</sub> desulfuring agent	COS desulfuring agent
Shape	Spheroid (4~8mm)	Column (2.3~3.3mm/)
Packing density (kg/m <sup>3</sup> )	350~650	500~700
Specific surface area (m <sup>2</sup> /g)	≥ 4.0	≥ 100
Pore volume (cm <sup>3</sup> /g)	≥ 0.4	≥ 0.5
KIYASHIKI hardness (kg)	≥ 2.0	≥ 1.5
Main components (wt%)	Calcium silicate : 39~49 Secondary amine : 46~55	Al <sub>2</sub> O <sub>3</sub> ≥ 85 Alkali metal compound : 8~12
Water content (wt%)	≤ 7	≤ 6
Absorption efficiency	≥ 0.15 (kg-CS <sub>2</sub> /kg)	—

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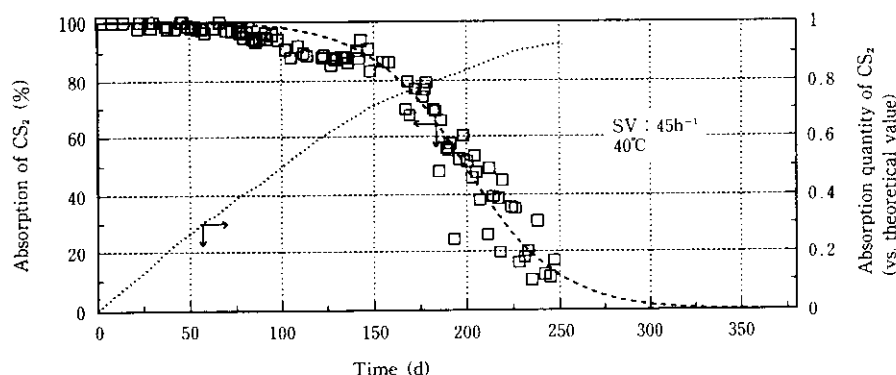
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Fig. 1 Desulfurizing efficiency of CS<sub>2</sub> desulfurizing agent



## 2.2 Features of Desulfurizing Agents

- (1) Desulfurizing is possible in a low temperature zone approximating room temperature and at low pressure, and compared with other high-temperature and high-pressure processes, this dry process is advantageous both in cost and in maintenance.
- (2) These desulfurizing agents can be used in the coexistence with unsaturated hydrocarbons (olefine, diene, etc.), naphthalene, benzene, toluene, xylene, etc.
- (3) Since all these desulfurizing agents are formed products, the pressure loss in the desulfurizing column is reduced, and handling operations such as loading and removal are easy.
- (4) Pre-processing at the time of use is unnecessary.

## 2.3 Purposes

The main purposes of the use of CS<sub>2</sub> and COS desulfurizing agents are shown below.

- Coke oven gas
- City gas
- Off-gas of petrochemical plants
- Off-gas of oil refineries

## 3 Performance and Actual Records

### 3.1 Performance

#### 3.1.1 CS<sub>2</sub> desulfurizing agent

Figure 1 shows the test results of the CS<sub>2</sub> desulfurizing agent in absorbing CS<sub>2</sub> from coke oven gas. The CS<sub>2</sub> desulfurizing agent can maintain a removal ratio of 70% or above for a half year or longer under the conditions of SV (space velocity) = 45 h<sup>-1</sup>, a temperature of 40°C, and an absolute pressure of 10.5 kg/cm<sup>2</sup>.

#### 3.1.2 COS desulfurizing agent

Figure 2 shows the test results of the COS desulfurizing agent in eliminating COS from coke oven gas. The COS desulfurizing agent can maintain a removal ratio of 90% or above for a half year or longer under the conditions of SV = 500 h<sup>-1</sup>, a temperature of 45°C, and atmospheric pressure.

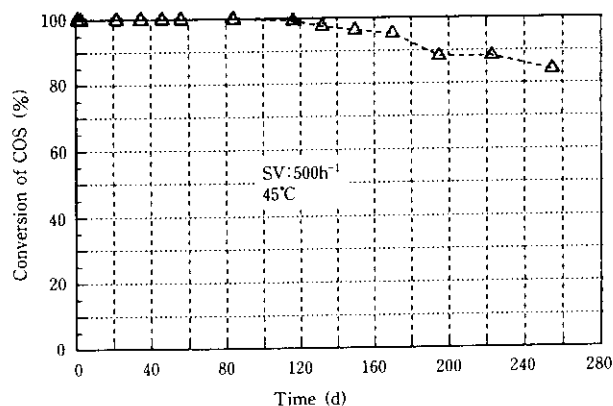


Fig. 2 Desulfurizing efficiency of COS desulfurizing agent

## 3.2 Actual Records

The CS<sub>2</sub> desulfurizing agent has been used at Mizushima Works for refining coke oven gas into city gas since November 1987. The CS<sub>2</sub> and COS desulfurizing agents have been used for the same purposes by Mitsubishi Chemical Co., Ltd. since December 1993.

## 4 Concluding Remarks

The CS<sub>2</sub> and COS desulfurizing agents developed by Kawasaki Steel have won favorable evaluations from users for excellent desulfurizing performance at a low temperature and low pressure. Further, the shape, hardness, etc., of both the desulfurizing agents can be modified to suit various uses.

## References

- 1) Kawasaki Steel Corp.: Jpn. Kokai 1-123614
- 2) Kawasaki Steel Corp.: Jpn. Kokai 2-276891
- 3) Kawasaki Steel Corp.: Jpn. Kokai 63-287548
- 4) S. Nakashima, K. Takaki, and F. Yoshikawa: *Kawasaki Steel Giho*, **20**(1988)3, 249-250

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