Effective Area of Graphite Tablets in Amalgam Decomposer*

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The effective area, $\bar{S}_h$, of graphite tablets in amalgam decomposer is one of the most important values in designing the packed tower.

The value, $\bar{S}_h$, is represented as follows :

$$\bar{S}_h = \alpha_h S_h \dots \dots \dots (1)$$

$$m_h = \frac{\bar{S}_h}{SH} = \frac{\alpha_h S_h}{SH} \dots \dots \dots (2)$$

where

S_h : Apparent area of tablets (m^2)

$\bar{S}_h$: Effective area of tablets (m^2)

m_h : Effective area per unit volume of tower (m^2/m^3)

α_h : Coefficient of effective area

S : Sectional area of tower (m^2)

H : Height of tower (m)

Then, the value m_h represents theoretically as follows :

(i) Spherical Tablet :

$$m_h = \frac{4 \pi r^2 \alpha_h N}{SH} \times 10^{-6} \dots \dots \dots (3)$$

where

r : Radius of tablet (mm)

N : Packed number

(ii) Cylindrical Tablet :

$$m_h = \frac{2 \pi r(r+l) \alpha_h N}{SH} \times 10^{-6} \dots \dots \dots (4)$$

where

r : Radius of cylinder (mm)

l : Height of cylinder (mm)

The decomposition of amalgam is electrochemical, so that, these values, α_h and m_h , are measured by means of electrochemical methods⁽¹⁾.

Fig. 1 shows the amalgam decomposer, and the size of this tower is as follows :

Diameter	75 mm ϕ
Height	80 mm
Diameter of tablet	10 mm ϕ
Packed number	420 tabs.
Distributor	1.5 mm ϕ holed plate

and also the experimental conditions are :

Concentration of caustic soda 20-50%

Concentration of amalgam 0.03-0.25%

Fig. 1 Amalgam decomposer.

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The original written in Japanese can be seen in J. Electrochem. Soc. Japan, 27, (1959).

Fig. 2 Hydrogen overpotential in amalgam decomposer.

$\sigma(a)$

Fig. 4 Current distribution in amalgam.

Flow of amalgam 0-5 kg/min
Temperature 50°C

The hydrogen overpotential at graphite tablets during operation is measured as in Fig. 2, which is referred to Hg-HgO electrode.

Both the total current and the overpotential correspond to amalgam flow at lower range. But above 6-6.5 kg/min, current does not increase more.

Effective area is calculated by the same method of previous paper concerning the shielding effect of evolving gas at electrode surface⁽²⁾.

Such deviations of overpotential from theoretical value may be due to irregularity of electrical field as shown in Figs. 4 and 5, and then to shielding effects of evolving gas and amalgam.

The values, α_h and m_h , are calculated from empirical results, and are represented as Fig. 3. Then, we may conclude that, actual value of m_h is 170-200 m²/m³ on 10 mm ϕ spherical tablets.

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Literature :

- (1) F. Hine, S. Yoshizawa, S. Okada, *J. Electrochem. Soc. Japan*, 27, 134 (1959).
- (2) F. Hine, S. Yoshizawa, S. Okada, *J. Electrochem. Soc. Japan*, 24, 370 (1956).

Fig. 3 Effective area of amalgam decomposer.

$\sigma(a_1)$ $\sigma(a_2)$ $\sigma(a_3)$

Fig. 5 Current distribution in amalgam.