Consideration for Amalgam Decomposition from the Stand-Point of Potential Theory*

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The electrical field along the amalgam decomposer was analyzed by means of the two-dimensional potential theory. The so-called "Comb" type grid was taken up as example in this work for the convenience of mathematical analysis.

If it is assumed that the contact resistance between amalgam and graphite is much smaller than the ohmic resistance in caustic soda, it will be negligible. Therefore, its field is modified as $z$-plane in Fig. 2.

Then, current densities, $j$, are shown as follows:

- on the surface of graphite:
  \[ j = \frac{\varepsilon V}{\alpha} \csc \frac{\pi y}{2\alpha} \]

- on the surface of amalgam:
  \[ j = \frac{\varepsilon V}{\alpha} \csc \frac{\pi (x - \xi)}{2\alpha} \]

These specific current densities on the graphite cathode and the amalgam anode are numerically calculated, and are shown in Figs. 3 and 4, respectively.

Ordinary, large current flows through local cell composed of amalgam and grids. Therefore, the amalgam decomposition must be considered not only from the electrochemical stand-point in which the hydrogen overpotential of grid surface is very important, but also from the viewpoint of the above mentioned electrical field.

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Fig. 3 Specific current density on the grid.

Fig. 4 Specific current density on surface of amalgam.

Fig. 5 Profile of decomposer.

Fig. 6 "Graphite Comb" Grid.

Fig. 7 "Steel Comb" Grid.

Fig. 8 "Steel Plate" Grid.
The practical test for decomposition of amalgam was also carried out in detail. Grids of several types were taken up, as example, as shown in:

1. Graphite Comb (Fig. 6)
2. Steel Comb (Fig. 7)
3. Steel Plate (Fig. 8)
4. Nickel Plated Steel Plate
5. Graphite Plate

![Graph of decomposition rates with grids of several types.](image)

Fig. 9 Decomposition rates with grids of several types.

Fig. 9 summarizes the results. So, it is concluded that,

1. Amalgam and grid should be set as near as possible.
2. Grid with lower hydrogen overpotential should be selected.
3. Hydrogen gas must be carried away from grid surface as quickly as possible.

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