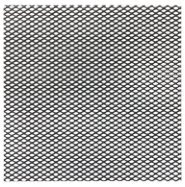
DSE® Electrode for Seawater and Diluted Brine Electrolysis

What is the DSE® electrode for seawater and diluted brine electrolysis?

A DSE® electrode is a dimensionally stable electrode for water solution electrolysis. It consists of a titanium substrate covered with an oxide coating layer that is mainly made up of platinum group metals. These metals are formed by our unique heat decomposition process. The DSE® electrode for the production of sodium hypochlorite is used as an anode to generate chlorine in an electrolysis process that uses seawater and diluted brine in an electrolysis bath. On the other hand, sodium hydroxide is generated as a cathode reaction. Following the anodic and cathodic reactions, the chlorine reacts with the sodium hydroxide in the electrolysis bath to form sodium hypochlorite.

Anodic side $2Cl^- \rightarrow Cl_2 + e^-$ **Cathodic side** $2Na^+ + 2H_2O + 2e^- \rightarrow 2NaOH + H_2$



The following reaction occurs in the solution.

$2NaOH + Cl_2 \rightarrow NaClO + NaCl + H_2O$

The DSE® electrode is a dimensionally stable electrode that has better electrolysis and processing characteristics than a conventional platinum-covered titanium electrode, and is thus an excellent alternative to the conventional type.

Electrochemical characteristics

Anode potential (chlorine evolution potential)

With a conventional platinum-covered titanium electrode, the chlorine evolution potential tends to rise with an increase in the current density. With the DSE® electrode for the production of sodium hypochlorite, however, the chlorine evolution potential remains stable with a change in the current density. In addition, the potential of the DSE® electrode enables chlorine evolution at a potential that is 500 mV or more lower than that of a platinum-covered titanium electrode. (See the following Figure 1.)

The DSE® electrode for the production of sodium hypochlorite remains stable even when the temperature of the supply diluted brine varies and exhibits a chlorine evolution potential that is 500 mV or more lower than that of a platinum-covered titanium electrode. (See the following Figure 2.)

Current efficiency

The level of direct-current power is determined from the following computational expression.

$W=756(kAh/chlorine\ ton)\times V(v)\times 100/\eta$

W ; Direct-current consumption(kWh/chlorine ton)　V ; Electrolytic voltage(v)

η ; Current efficiency(%)

For economical operation, it is important to lower the electrolytic cell voltage and increase the current efficiency. The values of the electrolytic cell voltage and the current efficiency depend on the structure of the electrolytic cell. When a DSE® electrode for the production of sodium hypochlorite is compared with a conventional platinum-covered titanium electrode under the same conditions, the current efficiency of the former is found to be at least 10% higher than that of the latter. (See the following Figure 3.)

Figure 1 Current density and chlorine evolution potential

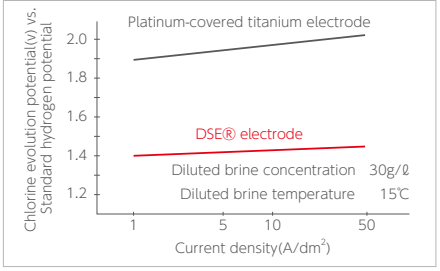


Figure 2 Diluted brine temperature and chlorine evolution potential

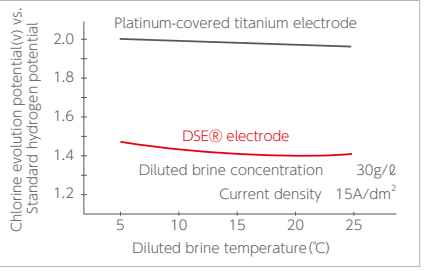
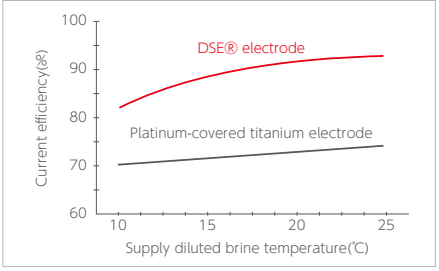


Figure 3 Diluted brine temperature and current efficiency



Applications of this electrode

Electrolysis of seawater

01 Thermal and nuclear power plants
Elimination of algae in seawater for cooling

02 Oil refinery
Sterilization

03 Sewage treatment
Sterilization

Electrolysis of diluted saline

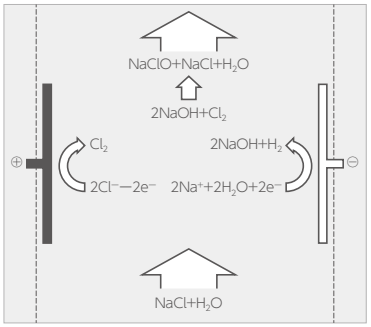
04 Waterworks
Sterilization

05 Sewage treatment plant
Sterilization

06 Drinking water produced in plant
Sterilization

07 Swimming-pool water
Sterilization

08 Other industrial waste liquids
Iron removal, manganese removal, reductant removal, decolorization



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