

Electrolysis Encyclopedia Article

Electrolysis

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Electrolysis

Electrolysis is the process of using an electric current to breakdown a compound by chemical conversion. The compound must be in a fluid state, either dissolved or molten, to permit the flow of electricity. Such a fluid is called an electrolyte. The ions (charged particles) within the electrolyte carry the current, unlike electricity in a metal conductor, where electrons are responsible. A negatively charged ion is called an anion and a positively charged ion is known as a cation.

Electrolysis was first performed by William Nicholson (1753-1815) and Anthony Carlisle in 1800. Using Alessandro Volta's recently-invented Voltaic pile battery, they immersed two electrodes into water and allowed electricity to flow. This caused the water to break down into its two components; hydrogen and oxygen. As hydrogen ions were converted into hydrogen atoms, they combined to form hydrogen molecules that bubbled off. This process is nearly the reverse of the process that creates a battery's electricity. A few years later, in 1807, English chemist Humphry Davy used electrolysis to discover the elements potassium and sodium, but his work was eclipsed by his assistant, Michael Faraday.

Faraday coined the words *ion*, *electrolyte*, and *electrolysis*. On British scholar William Whewell's (1794-1866) advice, he named the conductors that carried the electric current electrodes, calling the positive electrode an anode and the negative electrode a cathode, terms still in use today.

In 1832 Faraday laid the foundation for modern electrochemistry with his laws of electrolysis. The two laws related the mass, atomic weight, and valence (combining power) of the liberated substance to the quantity of electricity passed through the solution.

One of the first large-scale industrial applications of electrochemistry was the electrolysis of sodium chloride (salt), a complex process which was simplified by the use of separate anode and cathode compartments. One such process, the Castnet-Kellner split-cell, electrolyzed sodium chloride by using a mercury cathode and an inert anode.

The electrolytic process is essential for the production of pure metals, reducing the cost of production considerably. Electrolysis is used to refine aluminum and purify copper. It has even been suggested that the process could provide an environmentally-safe source of energy. Sunlight would electrolyze water, and the hydrogen it produced would be used for fuel in the home, industry, and automobiles. Storage would be easy, and the only by-product would be water. Scientists continue to investigate this technology.