



HISTORICAL CHEMISTRY

The Riddle of Electrolysis

Historical Perspective

When Michael Faraday performed his electrochemical experiments, little was known about the relationship between matter and electricity. Chemists were still debating the existence of atoms, and the discovery of the electron was more than 50 years in the future. Combining his talents in electrical and chemical investigation, Faraday pointed researchers to the intimate connection between chemical reactions and electricity while setting the stage for the development of a new branch of chemistry.

Electrifying Experiments

In 1800, Italian physicist Alessandro Volta introduced his *voltaic pile*, better known as the battery. The stack of alternating zinc and silver disks provided scientists with a source of electric current for the first time.

That same year, chemists discovered a new phenomenon using Volta's device. They immersed the two poles of a battery at different locations in a container of water. The current caused the water to decompose into its elemental components, with hydrogen evolving at the positive pole of the battery and oxygen evolving at the negative pole. Similar experiments using solutions of certain solids dissolved in water resulted in the decom-

position of the solids, with the two products of the solids' breakdown also evolving at opposite poles of the battery. This electrochemical decomposition was later named *electrolysis*.

The Roots of Electrolytic Theory

The discovery of electrolysis led two pioneering chemists to ponder the connection between chemical forces and electricity. One of the chemists was Humphry Davy, who thought that chemical bonding must be driven by the same forces that drive electrical attractions.

The Swedish chemist Jöns Jacob Berzelius took Davy's idea a step further. He postulated that matter consisted of combinations of "electropositive" and "electronegative" substances, classifying the parts by the pole at which they accumulated during electrolysis.

These ideas inspired two early electrolytic theories, each of which ultimately proved incorrect but contributed to our present understanding of the phenomenon. The *contact theory* proposed that electrolytic current was due merely to the contact of the battery's metals with the electrolytic solution. The *chemical theory*, on the other hand, attributed the current to undefined changes in the solution's components.

▼ Chlorine being produced by electrolysis.

