Electric Arc Encyclopedia Article

Electric Arc

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Electric Arc

The discovery of electricity in the late 1700s had a momentous impact on all branches of science. In early experiments, researchers explored the behavior of sparks and electric current. Eventually, Italian physicist Alessandro Volta built what was then called a "pile" of electrical cells--essentially a battery--that was capable of producing a strong current. It was this invention that led to the discovery of the electric arc.

Scientists around the world soon began assembling larger batteries, but British chemist Sir Humphry Davy was the first to concentrate on the arc produced between the two electrodes of a battery. When the electrodes are separated, a strong electric current will leap across the space from one electrode to the other, producing a curve of intense light and heat. The current is conducted by gases in the air surrounding the electrodes. Davy first noticed that the arc could be improved by using carbon electrodes instead of metal, as was then the practice. This discovery gave birth to the entire field of electric lighting. From 1805 onwards, Davy and other scientists demonstrated the electric arc to the public. The brilliant light it produced was impressive, but the commercial use of arc lamps was delayed until cheaper sources of power were invented in the late 1800s.

When interest in the electric arc as a source of light revived, basic research on the nature of the arc also resumed. At the time, electric arcs often became unstable, causing them to hiss and sputter. In 1899, a British electrical engineer named Hertha Ayrton solved this baffling problem, which was caused by oxidation of carbon from the positive electrode. Her discovery suggested changes in the way electrodes were manufactured, leading to greater arc stability and more effective lighting. As a result, Ayrton was elected the first woman member of the Institution of Electrical Engineers.

Today the electric arc remains useful as a source of light and heat in many special applications such as arc welding, movie filming and projection, and testing of aerospace materials. Electric arcs can also be used as a source of ions in the study of subatomic particles. The strong electric field between the electrodes ionizes the surrounding gases, creating positive and negative particles from the gas molecules.