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USE AND METHOD OF CONTROLLING AN ELECTRIC ARC

An electric arc, or arc discharge, is an electrical breakdown of a gas that produces a prolonged electrical discharge. The current through a normally nonconductive medium such as air produces plasma; the plasma may produce visible light. An arc discharge is characterized by a lower voltage than a glow discharge and relies on thermionic emission of electrons from the electrodes supporting the arc. An archaic term is voltaic arc, as used in the phrase "voltaic arc lamp".

Techniques for arc suppression can be used to reduce the duration or likelihood of arc formation.

Industrially, electric arcs are used for welding, plasma cutting, electrical discharge machining, asan arc lamp in movie projectors, and follow spots in stage lighting. Electric arc furnaces are used to produce steel and other substances. Calcium carbide is made this way as it requires a large amount of energy to promote an endothermic reaction (at temperatures of 2500 °C).

Carbon arc lights were the first electric lights. They were used for street lights in the 19th century and for specialized applications such as searchlights until World War II. Today, low-pressure electric arcs have multiple applications. Fluorescent tubes, mercury, sodium, and metal halide lamps are used for lighting; xenon arc lamps are used for movie projectors.

Formation of an intense electric arc, similar to a small-scale arc flash, is the foundation of exploding bridge wire detonators.

A major remaining application is in high voltage switchgear for high-voltage transmission networks. Modern devices use sulfur hexafluoride at high pressure in a nozzle flow between separated electrodes within a pressure vessel. The AC fault current is interrupted at current zero by the highly electronegative SF₆ ions absorbing free electrons from the decaying plasma. A similar air-based technology

has largely been replaced because many noisy units in series were required to prevent the current re-igniting under similar supergrid conditions.

Electric arcs have been studied for electric propulsion of spacecraft.

They are used in the laboratory for spectroscopy to create spectral emissions by intense heating of a sample of matter.

Undesired arcing in electrical contacts of contactors, relays and switches can be reduced by devices such as contact arc suppressors and RC snubbers or through techniques including:

1. immersion in transformer oil, dielectric gas or vacuum;
2. arc chutes;
3. magnetic blowouts;
4. pneumatic blowouts;
5. sacrificial ("arcing") contacts;
6. damping materials to absorb arc energy, either thermally or through chemical decomposition.

Scientists have discovered a method to control the path of an arc between two electrodes by firing laser beams at the gas between the electrodes. The gas becomes a plasma and guides the arc. By constructing the plasma path between the electrodes with different laser beams, the arc can be formed into curved and S-shaped paths. The arc could also hit an obstacle and reform on the other side of the obstacle. The laser-guided arc technology could be useful in applications to deliver a spark of electricity to a precise spot.