

# Electric Insulator Encyclopedia Article

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# Electric Insulator

An electric insulator performs the opposite task of an electric conductor: an insulator prevents the flow of electric current. The difference between a conductor and an insulator can be stated in terms of *resistivity*. The difference between the resistivity of copper (a conductor) and glass (an insulator) is more than 100 billion-billion ( $10^{25}$ ) times.

The word "insulator" is credited to French-English physicist John Théophile Desaguliers (1683-1744), who borrowed from the Latin word for "island," because insulators could surround electric current just as water surrounds an island.

When Benjamin Franklin flew his famous kite in the thunderstorm in 1752, he used a silk handkerchief as an insulator. When American physicist Joseph Henry began his experiments with electricity, he had to painstakingly make his own insulated wire, using strips of his wife 's silk petticoat to wrap the wire. In 1812 two Germans named Sommering and Schilling used india-rubber to insulate wire that was used to detonate mines. Ernst Werner von Siemens (1816-1892) used wire insulated with gutta percha, the gum of a Malayan tree, in 1847. Gutta percha was so superior it had no rivals until the invention of polyethylene insulation in the 1930s.

It is the composition of the insulator that accounts for its extremely high resistance to electricity. Generally, any material that is a poor conductor of heat is a poor conductor of electricity. There is no such thing as a "perfect" insulator; all insulators conduct small amounts of current, but the better their atomic and molecular structure, the better their insulation. Ceramics and glass are used as insulators on electric transmission line poles. Flexible plastics are used in electric cables. Paper, mica, air and some metal oxides are used as *dielectric* materials in capacitors, which are devices that store electric charges.

If an insulator is subjected to an unusually high voltage, it can cause a breakdown of the bonds that hold its atoms together. The "breakdown voltage" varies, depending on the material being used as an insulator, but once it occurs the ability of the insulator to resist electric flow is reduced considerably, allowing current to "leak" through.