A dielectric material is one that is a poor conductor of electricity, but an efficient supporter of electrostatic fields. If the flow of current between opposite electric charge poles is kept to a minimum while the electrostatic lines of flux are not impeded or interrupted, an electrostatic field can store energy. This property is useful in capacitors, especially at radio frequencies. Dielectric materials are also used in the construction of radio frequency transmission lines.

In practice, most dielectric materials are solid. Examples include porcelain (ceramic), mica, glass, plastics, and the oxides of various metals. Some liquids and gases can serve as good dielectric materials. Dry air is an excellent dielectric, and is used in variable capacitors and some types of transmission lines. Distilled water is a fair dielectric. A vacuum is an exceptionally efficient dielectric.

An important property of a dielectric is its ability to support an electrostatic field while dissipating minimal energy in the form of heat. The lower the dielectric loss (the proportion of energy lost as heat), the more effective is a dielectric material. Another consideration is the dielectric constant, the extent to which a substance concentrates the electrostatic lines of flux. Substances with a low dielectric constant include a perfect vacuum, dry air, and most pure, dry gases such as helium and nitrogen. Materials with moderate dielectric constants include ceramics, distilled water, paper, mica, polyethylene, and glass. Metal oxides, in general, have high dielectric constants.

The prime asset of high dielectric constant substances, such as aluminum oxide, is the fact that they make possible the manufacture of high value capacitors with small physical volume. But these materials are generally not able to withstand electrostatic fields as intense as low dielectric constant substances such as air. If the voltage across a dielectric material becomes too great, for example, if the electrostatic field becomes too intense, the material will suddenly begin to conduct current. This phenomenon is called dielectric breakdown. In components that use gases or liquids as the dielectric medium, this condition reverses itself if the voltage decreases below the critical point. But in components containing solid dielectrics, dielectric breakdown usually results in permanent damage.

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