CONDUCTOR MATERIAL

In science and engineering, conductors are materials that contain movable charges of electricity.

How works

When an electric potential difference is applied across different points of a conductor, the mobile charges within the conductor are forced to move, and an electric current between those points appears in accordance with Ohm's law.

Conductor materials

While many conductors are metallic, there are many non-metallic conductors as well, including all plasmas. See electrical conduction for more information on the physical mechanism for charge flow in materials. Other materials Non-conducting materials lack mobile charges and are called insulators. A material can be an electrical conductor without being a thermal conductor, although a metal can be both an electrical conductor and a thermal conductor. Electrically conductive materials are usually classified according to their electrical resistance; ranging from high to null resistance, there are semiconductors, ordinary metallic conductors (also called normal metals), and superconductors [[1]].

Properties

Electrical conductors has the property of conducting electrical current which is basically the flow of free electron inside the conductor.Under normal conditions, all materials offer some resistance to flowing charges, which generates heat. The only thing which restricts the amount of electric current in a conductor is the thermal limit above which it is damaged due to excessive heat produced by the electrical current.Thus, proper design of an electrical conductor includes an estimate of the temperature that the conductor is expected to endure without damage, as well as the quantity of electrical current.

The motion of charges also creates an electromagnetic field around the conductor that exerts a mechanical radial squeezing force on the conductor. A conductor of a given material and volume (length x cross-sectional area) has no real limit to the current it can carry without being destroyed as

long as the heat generated by the resistive loss is removed and the conductor can withstand the radial forces. This effect is especially critical inprinted circuits, where conductors are relatively small and the heat produced, if not properly dissipated, can cause fusing (melting) of the tracks..

Power engineering

In power engineering, a conductor is a piece of metal used to conduct electricity, known colloquially as anelectrical wire.

Conductor size

In United States, conductors are measured by American wire gauge for smaller ones, and circular mils for larger ones.

For example, a '4/0' conductor is about a half inch in diameter, while a '795 000' conductor is about an inch in diameter.

In other places, conductors are often measured by their cross section in square millimeters.

Conductor materials (comparison)

Of the metals commonly used for conductors, copper has the highest conductivity. Silver is more conductive, but due to cost it is not practical except as a thin plating to mitigate skin effect losses at high frequencies. Because of its ease of connection by soldering or clamping, copper is still the most common choice for most light-gauge wires.

Compared to copper, aluminium has worse conductivity per unit volume, but better conductivity per unit weight. In many cases, weight is more important than volume making aluminium the 'best' conductor material for certain applications. For example, it is commonly used for large-scale power distribution conductors such as overhead power lines. In cases of high voltage transmission lines, where long spans are adopted, aluminium is used over a steel core (known as ACSR). The steel core provides much greater tensile strength than would the aluminium alone. [2].

Gold is occasionally used for very fine wires such as those used to wire bond integrated circuits to their lead frames. The contacts in electrical connectors are also commonly gold plated or gold

flashed (over nickel). Contrary to popular belief, this is not done because gold is a better conductor; it isn't. Instead, it is done because gold is very resistant to the surface corrosion that is commonly suffered by copper, silver, or tin/leadalloys. This corrosion would have a very detrimental effect on connection quality over time; gold-plating avoids that.

Conductor voltage

The voltage on a conductor is determined by the connected circuitry and has nothing to do with the conductor itself. Conductors are usually surrounded by and/or supported by insulators and the insulation determines the maximum voltage that can be applied to any given conductor.

Conductor ampere capacity

The ampacity of a conductor, that is, the amount of current it can carry, is related to its electrical resistance: a lower-resistance conductor can carry more current. The resistance, in turn, is determined by the material the conductor is made from (as described above) and the conductor's size. For a given material, conductors with a larger cross-sectional area have less resistance than conductors with a smaller cross-sectional area.

For bare conductors, the ultimate limit is the point at which power lost to resistance causes the conductor to melt. Aside from fuses, most conductors in the real world are operated far below this limit, however. For example, household wiring is usually insulated with PVC insulation that is only rated to operate to about 60 C, therefore, the current flowing in such wires must be limited so that it never heats the copper conductor above 60 C. Other, more expensive insulations such as Teflon or fiberglass may allow operation at much higher temperatures.

The American wire gauge article contains a table showing allowable ampacities for a variety of copper wire sizes.

Source : http://engineering.wikia.com/wiki/Conductor_(material)