

Properties of electrical materials

Technology



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Solid electrical conductors are substances in which electrons move freely from one atom to another with the capacity to transmit electricity. An example of a material that possess such property is pure elemental silver that is believed to be the best solid electrical conductor encountered in everyday life. Others include copper, steel, aluminum, and brass. In electrical and electronic engineering systems, the conductors comprise solid metals molded into wires or etched onto circuit boards. Due to its excellent conductivity as a result of the presence of more localized electrons, copper is their used to make most of the wires. Aluminum is used for high voltage wires on electric poles because it's light in weight compared to other electric solid conductors (Ishihara, 2009).

Liquids containing free ions like mercury are excellent electrical conductors'. However, saturated salt water solutions also act as fair liquid conductors. The gases with a significant number of ions act as neutral conductor through gases tend to be poor conductors of electricity because their atoms are too far apart to allow the free exchange of electrons. Liquid conductors like salt solutions are applied in electrolysis for example in decomposing water into hydrogen gas and oxygen gas. Molten salt helps in the manufacture of aluminum by electrolysis. The liquid conductor is necessary for some types of batteries. Gases become electric wire when ionized, and typical examples are lightning bolts and spark from static discharge (Hartwell, 2014).

Solid electrical insulators block the flow of electric current across it. They possess a property that withstands thermal expansion mismatch, tension, flexing, compression, abrasion and the hostile chemical environment. The cracks promote the penetration of moisture hence promoting failure. Solid

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electrical insulators are used to insulate electric conductors from one another and also to confine electric currents to a given pathway. Such applications are in the insulation wires, electronic components, and switch gears. The insulators help in providing electrical dissipation function. The solid insulators can operate due to their resistivity, dielectric strength, and relative permittivity. Solid ceramic materials assist in supporting high voltage power lines on electricity pylons (Toberer, 2008).

Liquid or gas insulation provides flexible and cheap insulation that is not subject to mechanical failure. An example includes biphenyls that act as the insulating liquid in capacitors. Others are alkyl benzenes and polybutenes that are used in oil filled cables and high-pressure cables respectively. Liquid electric insulators also help in cooling transformers and act as a dielectric in a capacitor. Distilled water acts as an insulator and a coolant at the same time so long as it is kept free of impurities. However, silicone oil is preferred since it is less likely to cause corrosion and doesn't have to be pure. Other applications include large DC inverters, high power transistors and switching diodes, and compact high current transformers. Gas sulphur hexafluoride is used in electrical switch gear to prevent arcing (Toberer, 2008).

Ferrite magnets are non-corroding and brittle therefore used in electronic components such as radio antennas. They are of a sintered composite of iron oxide and barium that are of low cost and inexpensive. Iron in power transformers is used in consumer electronic products to step down the supply voltage to a level needed for the low voltage circuit they contain. The magnetic material, in this case, acts as a vital safety component that electrically isolates the end user from direct contact with lethal supply voltage (Narlikar, 2005).

References

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