



CONCEPT Insulators and conductors are two fundamental types of materials used in electrical engineering and design of electrical systems. Insulators have high electrical resistance and do not allow electrical current to flow freely through them, while conductors have low electrical resistance and allow electricity to flow freely. Insulators are used to protect people and equipment from electrical shocks and to prevent electrical energy from being wasted or lost through leakage. Conductors are used extensively in the design of electrical systems, including power grids, electronics, and motors, as they allow electrical energy to be efficiently and reliably transmitted and used.

BACKGROUND

The history of insulators and conductors dates back to the early days of electricity and the development of electrical engineering. Georg Ohm's discovery of electrical resistance in 1827 laid the foundation for the study of materials that can conduct or block electrical current. The concept of dielectric strength emerged in the early 20th century, as high voltage electrical systems became more widespread. The study of thermal conductivity dates back to the 19th century, with early researchers including Joseph Fourier and Lord Kelvin. The coefficient of thermal expansion was first studied by scientists in the 18th century. These concepts have played a crucial role in the development of modern electrical systems, from power grids and motors to electronic devices and consumer electronics. Today, engineers and designers continue to study these essential components and terms to improve the performance and efficiency of electrical systems in a wide range of applications.





EXAMPLES

ELECTRICAL RESISTANCE: This is a measure of how well a material resists the flow of electrical current. Materials with high resistance, such as insulators, are used to prevent the flow of electricity, while materials with low resistance, such as conductors, are used to allow the flow of electricity.

DIELECTRIC STRENGTH: This is a measure of how well an insulator can resist electrical breakdown under high voltage conditions. Materials with high dielectric strength are often used in high voltage applications, such as electrical transmission lines and capacitors.

THERMAL CONDUCTIVITY: This is a measure of how well a material conducts heat. Materials with high thermal conductivity, such as metals, are often used in applications where heat transfer is important, such as in electronics and engines.

OHM'S LAW: This formula describes the relationship between electrical current (I), voltage (V), and resistance (R) in a conductor. Ohm's Law states that $V = IR$, where V is measured in volts, I is measured in amperes, and R is measured in ohms.

Make sure it measures up

APPLICATION

One application of insulators and conductors is in the design of electrical wiring for buildings. Electrical wiring is typically made of copper or aluminum, which are good conductors of electricity. They are covered in a layer of insulation, which is made of materials such as PVC, rubber or fiberglass. The insulation serves to block the flow of electricity and prevent electrical shocks and fires.

In designing electrical wiring systems, engineers and designers must consider factors such as the amount of current that will be flowing through the wires, the length of the wires, and the temperature and humidity of the environment. By selecting the right combination of conductive and insulating materials and designing the wiring system to meet the specific needs of the building, engineers can ensure that the wiring system is safe, efficient and reliable.

