Resistivity and Conductivity

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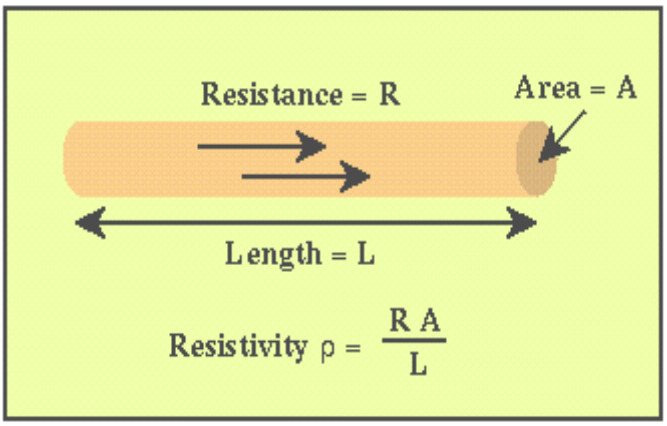
Introduction to Resistivity and Conductivity

What is Resistivity

Resistivity is the factor of resistance that takes into account the nature of the material. Although resistivity is temperature dependent, a given temperature can be assumed to calculate the resistance of a wire of given geometry.

In the case of a wire, resistivity is defined as the resistance in the wire, multiplied by the cross-sectional area of the wire, divided by the length of the wire. The units associated with resistivity are thus ohm.m (ohm - meters).



Resistivity is a fundamental parameter of the material making up the wire that describes how easily the wire can transmit an electrical current. High values of resistivity imply that the material making up the wire is very resistant to the flow of electricity. Low values of resistivity imply that the material making up the wire transmits electrical current very easily. The resistivity depends strongly on the presence of impurities in the material.

A quantity of resistivity is usually indicated by the Greek symbol rho. Since it is temperature dependent, it can be used to calculate the resistance of a wire of given geometry at different temperatures.

What is Conductivity?

The inverse of resistivity is called conductivity. There are contexts where the use of conductivity is more convenient.

Electrical conductivity = ? = 1/?

Electrical conductivity is commonly represented by theGreek letter?,

Relation between Conductivity & Resistivity

Resistivity and conductivity are two properties of electrical conductors --materials through which an electric current can flow.

These two properties have a definite mathematical relationship with one another.

Different conducting materials will have different conductivity and resistivity values. For example, conductivity and resistivity values of silver will differ from those of copper. Resistivity usually increases as the temperature of the wire rises, but conductivity decreases with rising temperature. Conductivity and resistivity values are independent of the length and thickness of the wire.

The unit of conductivity is the Siemen (S). A milli siemen (mS) = 1/1,000 S, a micro siemen (uS) = 1/1,000,000 S. Resistivity units are expressed in Ohms (?). A kilo ohm (k?) = 1,000?, a mega ohm (M?) = 1,000,000?.

Since conductivity and resistivity relate to an area that current is measured across, it is common to see the units expressed per volume such as M?-cm or uS-cm or umhos-cm

For a given type of conductor at a given temperature, conductivity is the reciprocal of resistivity. In the reciprocal of a fraction, the numerator and the denominator of the fraction switch places. So, since the resistivity of silver at 20 degrees Celsius is 0.0000000159 ohm-meters, the conductivity is 1 divided by this resistivity value, or 62,900,000 siemens per meter.

Want to know more about resistivity and conductivity?Click here to schedule a live session with an eAge eTutor!

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Reference links:

- http://www.en.wikipedia.org/wiki/temperature
- http://www.en.wikipedia.org/wiki/electrical_current
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