

Arc Resistance

Electrical Property of Polymers to Determine Conductivity

When electric current travels across an insulator's surface, this surface is damaged over time and then becomes conductive. Arc resistance is a measure of the time required to make an insulating surface conductive under a high voltage / low current arc in carefully controlled laboratory conditions.

Or in other terms, it is the ability of the plastic material to resist the action of a high voltage electrical arc.

It is used for differentiation among similar material with respect to their resistance to the action of high voltage low current to the surface of the insulation. By this action a conductive path is made due to thermal & chemical decomposition and erosion.

Since this electrical property is usually stated in terms of time required to form **plastic material electrically conductive**, the values are therefore reported in seconds (s).

Applications include:

1. Preliminary screening of plastic material
2. Quality control testing after field experience and other types of simulated service arc tests to establish a correlation
3. Detecting the results of changes in formulation

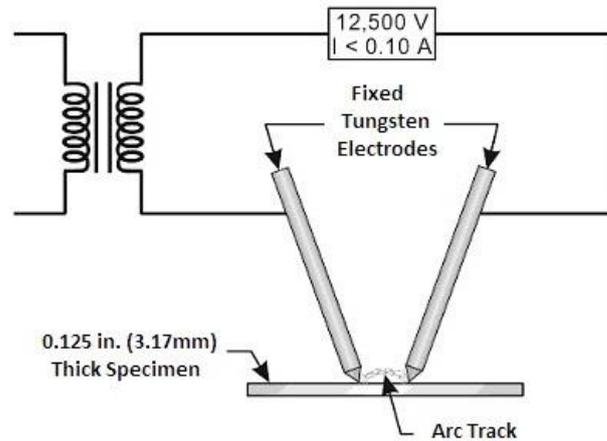


Check out more on Arc Resistance:

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How to measure Arc Resistance?

The most generally used standard tests to calculate arc resistance is **ASTM D495** (*of course there exists several other methods as well, but they are not discussed here*). For example, ASTM-D495 evaluates dry, uncontaminated samples, Test Method ASTM D 2132, D 2303, and D 3638 involve wet, contaminated specimens.



Schematic High Voltage, Low Current Dry Arc Resistance Test

ASTM D495-14 - Standard Test Method for High-Voltage, Low-Current, Dry Arc Resistance of Solid Electrical Insulation

This test method covers, in a preliminary fashion, the differentiation among similar materials w.r.t their resistance to the action of a high-voltage, low current arc close to the surface of insulation. This arc tends to form a conductive path in that location or may cause the material to become conducting due to the localized thermal and chemical decomposition and erosion.

The arc resistance of a material is determined by this method by measuring the total elapsed time of operation of the test until failure occurs.

There are four general types of failure which have been observed:

1. Many inorganic dielectrics become incandescent, at which point they are capable of conducting the current. However, when cooled, they return to their earlier insulating condition
2. Some organic compounds burst into flames without formation of a visible conducting path in the substance
3. Some organic compounds fail by tracking (i.e. a thin wiry line is formed between the electrodes)
4. Some compounds experience carbonization of the surface until sufficient carbon is present to carry the current

Generally, this method is not used in product design or material specifications. However, the results obtained in the test are values only used to distinguish materials of nearly identical composition such as identification, quality control and

development.

Arc Resistance of Thermoplastics & How to improve it?

Arc resistance depends on the type of thermoplastic materials.

1. **Thermoset phenolics** tend to carbonize easily and therefore have relatively poor arc resistance
2. Alkyds, melamine and fluorocarbons are excellent arc resistance materials

The arc resistance of thermoplastics can be improved substantially by the addition of reinforcements such as fiber glass, minerals and other inorganic fillers.

Arc Resistance Values of Several Plastics

Polymer Name	Min Value (sec)	Max Value (sec)
ABS - Acrylonitrile Butadiene Styrene	60.0	120.0
ABS Flame Retardant	60.0	60.0
ABS High Heat	45.0	85.0
ABS High Impact	45.0	85.0
ABS/PC Blend - Acrylonitrile Butadiene Styrene/Polycarbonate Blend	0.00	120.0
ASA - Acrylonitrile Styrene Acrylate	60.0	120.0
CA - Cellulose Acetate	50.0	300.0
CP - Cellulose Propionate	175.0	190.0
ECTFE - Ethylene Chlorotrifluoroethylene	50.0	50.0
FEP - Fluorinated Ethylene Propylene	165.0	180.0
HDPE - High Density Polyethylene	100.0	180.0
HIPS - High Impact Polystyrene	20.0	100.0
HIPS Flame Retardant V0	60.0	120.0
LCP Glass Fiber-reinforced	124.0	182.0

LCP Mineral-filled	145.0	183.0
LDPE - Low Density Polyethylene	130.0	160.0
PA 11, Conductive	70.0	130.0
PA 11, Flexible	70.0	130.0
PA 11, Rigid	70.0	130.0
PA 12 (Polyamide 12), Conductive	70.0	130.0
PA 12, Fiber-reinforced	70.0	130.0
PA 12, Flexible	70.0	130.0
PA 12, Glass Filled	70.0	130.0
PA 12, Rigid	70.0	130.0
PA 6 - Polyamide 6	118.0	125.0
PA 6-10 - Polyamide 6-10	120.0	120.0
PA 66 - Polyamide 6-6	130.0	140.0
PA 66, 30% Glass Fiber	60.0	135.0
PA 66, Impact Modified, 15-30% Glass Fiber	85.0	135.0
PA 66, Impact Modified	95.0	125.0
PAR - Polyarylate	125.0	125.0
PBT - Polybutylene Terephthalate	124.0	125.0
PBT, 30% Glass Fiber	10.0	130.0
PC (Polycarbonate) 20-40% Glass Fiber	30.0	120.0
PC - Polycarbonate, high heat	110.0	120.0
PCTFE - Polymonochlorotrifluoroethylene	350.0	400.0
PE - Polyethylene 30% Glass Fiber	140.0	140.0
PEEK - Polyetheretherketone	40.0	40.0

PEEK 30% Glass Fiber-reinforced	30.0	40.0
PEI - Polyetherimide	128.0	128.0
PEI, 30% Glass Fiber-reinforced	85.0	85.0
PEI, Mineral Filled	140.0	140.0
PESU - Polyethersulfone	20.0	120.0
PESU 10-30% glass fiber	75.0	75.0
PET - Polyethylene Terephthalate	75.0	125.0
PET, 30% Glass Fiber-reinforced	94.0	125.0
PETG - Polyethylene Terephthalate Glycol	75.0	125.0
PFA - Perfluoroalkoxy	180.0	180.0
PMP 30% Glass Fiber-reinforced	120.0	120.0
POM - Polyoxymethylene (Acetal)	200.0	220.0
POM (Acetal) Impact Modified	120.0	120.0
POM (Acetal) Low Friction	126.0	183.0
PP - Polypropylene 10-20% Glass Fiber	75.0	100.0
PP, 10-40% Mineral Filled	100.0	130.0
PP, 10-40% Talc Filled	100.0	130.0
PP, 30-40% Glass Fiber-reinforced	60.0	75.0
PP (Polypropylene) Copolymer	135.0	180.0
PP (Polypropylene) Homopolymer	135.0	180.0
PP, Impact Modified	135.0	180.0
PPA – 30% mineral	119.0	121.0
PPA, 33% Glass Fiber-reinforced	119.0	121.0
PPA, 33% Glass Fiber-reinforced – High Flow	0.00	0.00

PPA, 45% Glass Fiber	124.0	126.0
PPE - Polyphenylene Ether	53.0	80.0
PPE, 30% Glass Fiber-reinforced	120.0	120.0
PPS - Polyphenylene Sulfide	124.0	124.0
PPS, 20-30% Glass Fiber-reinforced	120.0	127.0
PPS, 40% Glass Fiber-reinforced	34.0	34.0
PPS, Glass fiber & Mineral-filled	116.0	182.0
PS (Polystyrene) 30% glass fiber	40.0	85.0
PS (Polystyrene) Crystal	60.0	80.0
PSU - Polysulfone	60.0	120.0
PSU, 30% Glass fiber-reinforced	100.0	100.0
PTFE - Polytetrafluoroethylene	200.0	300.0
PVC Rigid	60.0	80.0
PVDF - Polyvinylidene Fluoride	50.0	70.0
SAN - Styrene Acrylonitrile	100.0	150.0
SAN, 20% Glass Fiber-reinforced	60.0	75.0