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Partnering ideas with technology

INSULATION AND JACKET MATERIALS

Typical Characteristics of Popular Insulations

Extrudable Types

PVC is sometimes referred to as vinyl or polyvinyl chloride. Three types of vinyl compounds are in general use - standard, semi-rigid and irradiated.

Standard PVC is the 1000 volt or less plastic for hook-up, computer and control wires. Different compounds are used for 60°C, 80°C, 90°C and 105°C service, and for commercial and military applications.

Semi-Rigid PVC is much tougher than standard vinyl. It has greater resistance to abrasion and cut-through and more stable electrical properties.

Irradiated PVC has improved resistance to abrasion, cut-through, soldering and solvents. Irradiation changes the vinyl from a thermoplastic to a thermosetting material.

Depending upon the formulation the rated temperature will vary from -55°C to 105°C. Typical dielectric constant values can vary from 2.7 to 6.5.

Polyethylene (Solid and Cellular) is a very good insulation in terms of electrical properties. Low dielectric constant, a stable dielectric constant over all frequencies and a very high insulation resistance. In terms of flexibility, polyethylene can be stiff to very hard, depending on molecular weight and density - low density being the most flexible, with high density, high molecular weight formulations being very hard. Moisture resistance is excellent, but both types are flammable. Brown and Black formulations have excellent weather resistance. The dielectric constant is 2.3 for solid insulation and 1.5 for cellular (foamed) designs.

RULAN is a flame retardant polyethylene which has additives to inhibit the rate of burning. The additives have only a slight effect on physical or electrical properties of the insulation.

Chlorosulfonated Polyethylene (CSPE) is better known as Hypalon (a DuPont trademark). Used as a 105°C rated motor lead wire insulation, but is primarily a jacketing compound. It has excellent tear and impact strength, excellent abrasion, ozone, oil, and chemical resistance and good weathering properties. The material also has low moisture absorption, excellent resistance to flame and heat, and good dielectric properties.

Polypropylene (Solid and Cellular) is similar in electrical properties to polyethylene. This material is primarily used as an insulation. Typically, it is harder than polyethylene. This makes it suitable for thin wall insulations. UL maximum temperature ratings may be 60°C or 105°C. Most UL styles call for 60°C maximum. The dielectric constant is 2.59 for solid and 1.55 for cellular (foamed) designs.

KYNAR has great mechanical strength, superior resistance to abrasion and cut-through and substantially reduced cold-flow which makes it an excellent back plane wire insulation. Kynar is self-extinguishing and radiation resistant. It is a 135°C material.

ETFE Tefzel (DuPont tradename) is a 150°C material, has very good electrical properties, chemical inertness, high flex life and exceptional impact strength. It can withstand an unusual amount of physical abuse and is self-extinguishing.

ECTFE Halar (Ausimont Corporation trademark) has a specific gravity of 1.68, the lowest of any fluorocarbon. Its dielectric constant and dissipation factor at 1 Mhz are 2.6 and 0.013 respectively. Halar chars, but does not melt or burn when exposed to direct flame, and immediately extinguishes on flame removal. Its other electrical, mechanical, thermal and chemical properties are almost identical with Tefzel's. The temperature rating is -70°C to 150°C.

FEP Teflon (a DuPont trademark) is extrudable in a manner similar to PVC and polyethylene. This means that long wire and cable lengths are available. It has excellent electrical characteristics, chemical inertness and a service temperature of 200°C.

TFE Teflon is extrudable in a hydraulic ram type process. Lengths are limited due to the amount of material in the ram, thickness of the insulation, and preform size. TFE must be extruded over a silver or nickel coated wire. The nickel and silver coated designs are rated at 260°C and 200°C respectively.

PFA is the latest addition to DuPont's Teflon resins. Like the others it has outstanding electrical properties, high operating temperature (250°C), resistance to virtually all chemicals and flame resistance. The cost of Teflon is approximately 8 to 10 times more per pound than PVC compounds.

TPR Thermoplastic rubber has properties similar to those of vulcanized (thermosetting) rubbers. The advantage is that processed like thermoplastics, it is extruded over the conductor. Like many conventional rubber materials, TPR is highly resistant to oils, chemicals, ozone and other environmental factors. It has low water absorption and excellent electrical properties, and is very flexible with good abrasion resistance.

Silicone is a very soft insulation which has a typical temperature range from -80°C to 250°C. It has excellent electrical properties plus ozone resistance, low moisture absorption, weather resistance and radiation resistance. It typically has low mechanical strength and poor scuff resistance. While silicone rubber burns slowly, it forms a non-conductive ash which, in some cases, can maintain the integrity of the electrical circuit.

EPR Ethylene Propylene Rubber is a chemically cross-linked, thermosetting high temperature rubber insulation. It has excellent electrical properties combined with outstanding thermal stability and flexibility. It's resistance to compression, cutting, impact, tearing and abrasion is good. EPR is not attacked by acids, alkalis and many organic solvents. It is also highly moisture resistant. It has temperature ratings up to 150°C.

XLP Cross-Linked Polyethylene is rated up to 150°C. Cross-linking changes thermoplastic polyethylene to a thermosetting material which has greater resistance to environmental stress cracking, cut-through, ozone, solvents and soldering than either low or high density polyethylene. Sometimes it is designated as XLPE. Can be cross-linked either chemically or irradiated.

SBR Styrene Butadiene Rubber is flexible and offers good heat and moisture resistance at an economical cost. It must be jacketed for mechanical and chemical protection. Suitable for 75°C maximum temperature ratings.



ISO 9001:2008



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