

Making Cables Safer and Recyclable

A new alternative wire insulation to PVC offers better performance and significantly less environmental impact. Although PVC insulation is a mainstay of the wire and cable industry due to its mechanical and electrical properties and its low cost, it presents environmental issues due to its halogen content. Halogens are elements such as fluorine, chlorine, bromine and iodine that are highly reactive and can be harmful to people and animals. PVC contains approximately 29% chlorine by weight; in fact, the C in PVC is chloride, an ion of chlorine. Teflon® FEP and PTFE contains up to 76% fluorine and, when burned, produces toxic acid.

Halogens

Halogens, under normal circumstances, are very stable and present no danger. However, environmental problems arise when they burn.

A halogenic plastic can release hydrogen chloride, hydrogen fluoride, and other dangerous gases when burned. When hydrogen chloride comes in contact with water, it forms hydrochloric acid, a hazardous compound. Aside from its toxicity to humans and animals, these gases are also highly corrosive to metal.

The concern with common wire and cable insulating materials is the release of toxic gases, smoke, and acids when they burn.

Newer materials, primarily low-smoke, zero-halogen (LSZH) plastics, do not emit dangerous gases or smokes when burned. Though they may contain trace amounts of halogens—fewer than 1%—they are considered essentially halogen free.

Despite its improved safety features, the drawback to LSZH is that it cannot be conveniently recycled and reused. Like PVC, it will not safely decompose in a landfill.

mPPE insulation redefines wire

Alpha Wire’s EcoWire hook-up wire uses flexible Noryl insulation to provide an environmentally friendly alternative to PVC. Noryl is a modified polyphenylene ether (mPPE) thermoplastic that is inherently lighter, tougher, and more durable than PVC.

In addition to its ecological benefits, mPPE brings many performance advantages, including:

Minimized environmental impact

mPPE contains no halogens, phthalates, or heavy metals and meets RoHS and WEEE requirements.

Better dielectric strength

The superior dielectric properties of mPPE enables reduced wall thickness while maintaining the same electrical properties as PVC. The diameter of equivalent wires with mPPE insulation is up to 25% smaller than PVC-based wires. Figure 1 compares a 20 AWG hook-up wire of PVC to the same wire with mPPE.

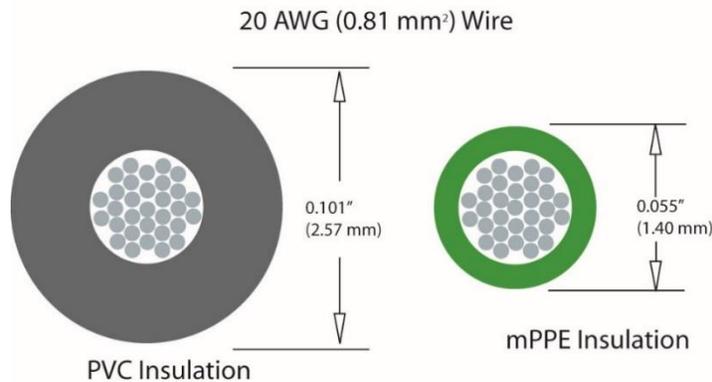


Figure 1. Close up comparison of 20AWG PVS hook-up wire vs 20AWG hook-up wire with mPPE insulation

Low specific gravity

The 1.03 specific gravity of mPPE is 25% to 40% lower than other insulation materials such as PVC, polyethylene, and cross-linked polyethylene. Along with the reduced wall thickness, the low specific gravity yields significant weight savings of around 25%.

Flame resistance

mPPE meets UL VW-1.

Wide temperature range

Wires and cable with mPPE insulation meet UL 1581 requirements for operation at 80°C and 105°C.

Durability

As shown in the comparison in Figure 2, mPPE’s better tensile strength and lower hardness rating combine to provide a durable and flexible insulation.

Recyclable

Plastics present significant disposal issues. Its harmful additives leak into the groundwater in landfills and produce toxic gases when burned. PVC can be recycled but it is not always technically feasible and rarely cost effective. Other common wire insulations present similar, if less severe, problems. On the other hand, mPPE is thermoplastic and more easily recycled as it does not contain the aforementioned hazardous materials.

Standard PVC vs. mPPE Insulation		
Properties	Std. PVC	mPPE
Hardness, C Scale	84	74
Tensile stress at break, psi (MPa)	3090 (21.3)	3335 (23)
Tensile strain at break, %	360	84
Volume resistivity, ohm-cm @ 100 V	2.7 ¹⁵	3.94 ¹⁶
Specific gravity	1.32	1.03

Figure 2. mPPE- insulated wire outperforms standard PVC in strength and flexibility

Drawbacks

As one might suspect, mPPE-insulated wire does have an added cost component. Moreover, it's a new product and engineers tend to be fairly risk adverse, commonly selecting the known over the unknown. However, that is not the case as this compound is widely accepted in a variety of industries. The Toyota Tundra is fully wired with mPPE-based components, and seven of the top ten global PC manufacturers (representing over 50% of the global market) have set goals to replace PVC with mPPE-based insulation.¹ A cost-benefit analysis featuring the superior performance characteristics of mPPE-based insulation—safety, size and weight reduction, and durability—should be done to ensure selection of the optimal solution.

Approved by UL Adoption of mPPE-based products such as EcoWire® should not be hindered by its perceived novelty. Underwriters Laboratories has approved mPPE as a suitable insulation for over fifty AWM cable styles; thus, it can be confidently applied where a tough, compact, and non- halogenated wire is required.

¹ Hanlon, Brian. "Green Manufacturing in the Wire, Cable and Harness Industry." Wiring Harness News. July/August 2009. 26 Oct. 2009