Improving Wire and Cable Identification with Advanced Laser Marking Additives

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Manufacturers can achieve superior marking quality, reduced energy consumption and long-term durability.

Wire and cable identification is a critical aspect of manufacturing and maintenance, enabling traceability, safety, inventory management and accurate troubleshooting. Without clear and consistent marking, connectivity issues can arise, leading to significant problems such as signal interference, miswiring and even catastrophic failures. Properly marked wires help personnel ensure that identical circuits are correctly connected across power buses, junctions and control systems.

In communication systems, poorly labeled cables can lead to incorrect connections, causing crosstalk between circuits. Proper identification ensures that shielding and grounding are maintained, preserving signal integrity. Miswiring can cause short circuits, damaging components and leading to potential fire hazards.

Identification methods typically involve text, logos, serial numbers, barcodes and color coding to convey essential information such as gauge, voltage and intended application. Various marking techniques exist, including inkjet printing and embossing. However, laser marking has emerged as a superior solution due to its precision, durability and adaptability across diverse materials and operating environments.

Laser Marking Advantages

Laser marking offers significant advantages over traditional printing methods, making it the preferred choice for high-performance applications. This noncontact technique utilizes a focused laser beam to permanently alter the surface of wire and cable jacketing materials without compromising material integrity. One of its primary benefits is that it does not physically touch the material, which eliminates the risk of deformation or wear, making it particularly useful for delicate components. In addition, when used with specialized additives, laser marking ensures that the insulation or jacketing materials remain intact without any degradation.

Another advantage of laser marking is its ability to create high-contrast marks that enhance readability and long-term identification. These markings are resistant to abrasion, chemicals and extreme environmental conditions, ensuring they remain visible over time. Unlike traditional printing methods, laser marking does not require ink or hazardous solvents, thereby eliminating the need for surface pretreatment and post-processing treatments.

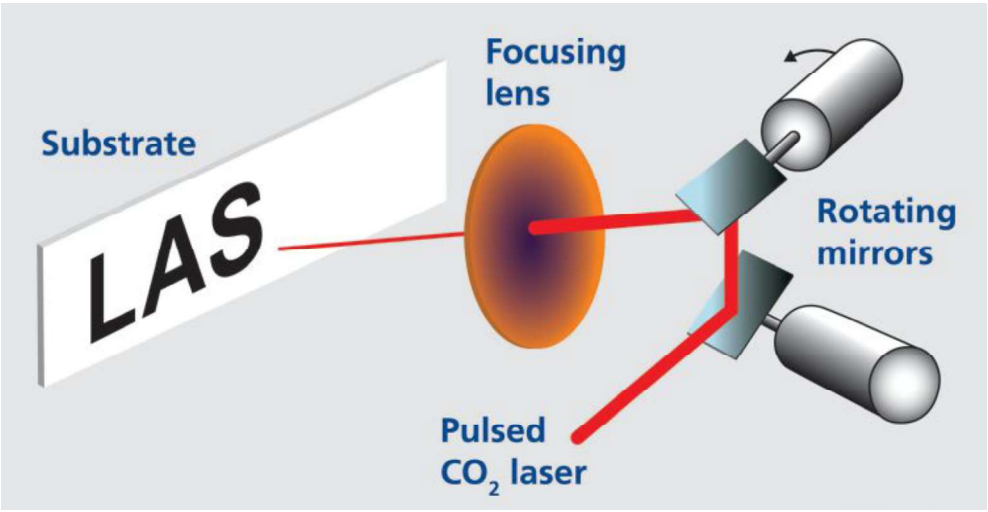
Optimizing Laser Marking with Advanced Additives

AGC Chemicals has developed Fluon+™ IR-MARK and Fluon+™ UV-MARK additives to enhance the efficiency and performance of laser marking for wire and cable applications. These additives reduce power consumption, increase marking speed and minimize thermal degradation.

Available as concentrated formulations, Fluon+ IR-MARK and UV-MARK are part of the Fluon+ Melt Processable Compounds line and designed for stable integration into fluoropolymer resins, such as FEP, ETFE and PFA. Their proprietary susceptor materials improve base material reflectivity and efficiently direct laser energy to achieve precise marking without excessive heat generation. This capability is particularly beneficial for infrared-based applications where thermal stability is a priority.

Key Additive Benefits

The Fluon+ IR-MARK and UV-MARK additives significantly enhance laser energy absorption, optimizing the interaction between the laser beam and the substrate for superior marking quality. By concentrating the laser energy at the surface level, these additives allow for effective marking at lower power settings, resulting in greater operational efficiency and reduced energy costs. Additionally, the controlled heat absorption minimizes the risk of thermal damage to the wire and cable materials, preserving their structural integrity and performance.



Achieving Maximum Contrast

Colors	Laser Type	Recommended - MARK(s) Types	Print will be this color	Comments
White Yellow Light Gray Light Brown Light Blue Light Green Light Violet Pink Orange Red Aqua	IR (Fiber, NdYAG, CO2)	IR-MARK	Dark brown to black	Important to run a "flat surface" test, using variable loading levels of the IR-MARK or UV-MARK additive system and varying power settings to determine optimums.
	UV	UV-MARK	Light brown to black	
Black Dark Brown Dark Green Dark Blue Dark Violet	IR (Fiber, NdYAG, CO2)	IR-MARK	Dark brown to black	Contrast will be reduced due to dark marking on a dark background.
	UV	UV-MARK	Dark brown to black	

When incorporated into wire and cable jacketing alongside AGC's standard color masterbatch formulations, these concentrates produce durable, high-contrast markings that enhance visibility. Because they eliminate the need for traditional inks and labeling, Fluon+ IR-MARK and UV-MARK additives provide a more sustainable solution that aligns with industry compliance standards and environmental regulations. They blend well into existing resin and color formulations and are compatible with various melt processable resin systems.

Laser Marking Additive Grades and Applications

Fluon+ IR-MARK and UV-MARK additives are specifically engineered for fluoropolymer jacketing and insulation applications requiring laser-markable surfaces. Each additive caters to distinct laser marking technologies.

Fluon+ IR-MARK is designed for use with infrared (IR) laser marking systems. It is particularly suitable for applications requiring durable, high-contrast markings that can withstand harsh environmental conditions, including UV radiation and abrasion. These attributes make it ideal for wire and cable jackets where permanent identification is necessary.

Fluon+ UV-MARK is formulated for ultraviolet (UV) laser marking systems. This additive provides a high-contrast marking solution for product identification and traceability, performing exceptionally well on light-colored materials.

Both additives are available in ETFE-, FEP- and PFA-based concentrate forms, ensuring broad compatibility and customization for specific industry needs. Standard standalone concentrates are available, with additional custom formulations offered upon request.

Achieving Success

Achieving the best results with IR-MARK and UV-MARK products requires balancing several key factors, including product loading, print speed and laser power. Finding the optimal combination of these elements ensures high-quality markings while minimizing potential damage to the material. Printing a test pattern is a valuable step in determining the best settings for a given application.

Before testing, it is recommended that compounds be molded into a flat surface, as this allows for accurate and consistent evaluation. AGC Chemicals Americas can assist in this process to ensure proper preparation. Additionally, printer manufacturers should have the capability to mark test patterns on these flat surfaces, enabling a controlled and repeatable testing environment.

To assess the quality of the markings, a photomicroscope is recommended. This tool helps examine print resolution and overall print quality. By following these best practices, users can optimize their marking process and achieve reliable, high-quality results.

Conclusion

Laser marking technology, when enhanced with Fluon+ IR-MARK and UV-MARK additives, provides an optimized, sustainable and high-performance solution for wire and cable identification. By leveraging these advanced formulations, manufacturers can achieve superior marking quality, reduced energy consumption and long-term durability. For tailored recommendations and testing support, visit AGC Chemicals Americas.

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Company Profile:

AGC Chemicals Americas*, Exton, PA, USA, a leading producer of fluorochemical technologies, compounds and specialty materials. The company offers the broadest range of high-performance fluoropolymers in the world including fluoroelastomers, PTFE, PFA and ETFE resins, fluoropolymer compounds, coatings and membranes.*
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