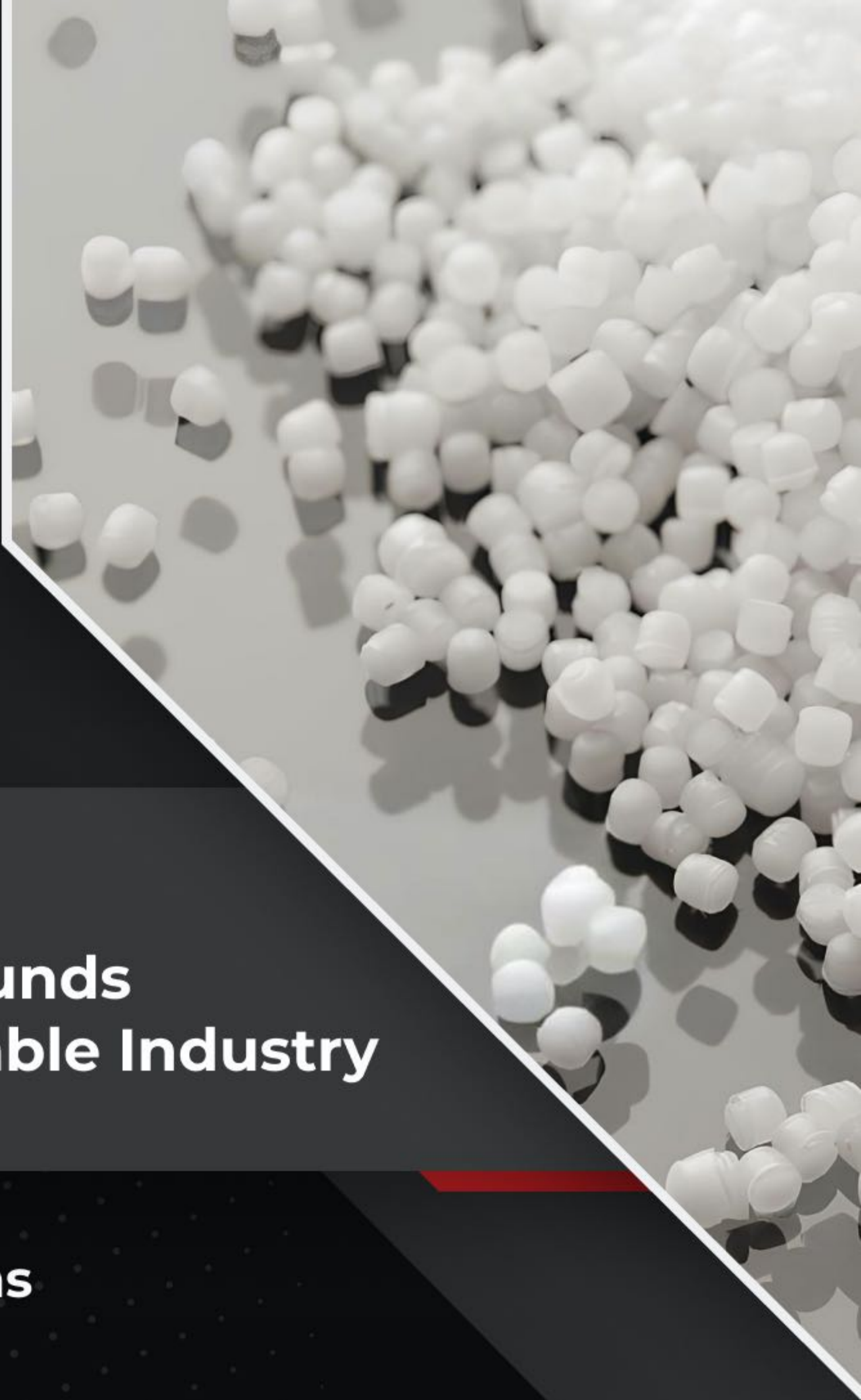




GRANULE WORLD
Joint Stock (pvt) Co,



Introduction to:
**Polyolefin Compounds
in the Wire and Cable Industry**

- PE & PP insulations
- Black jacketings
- HFFR materials

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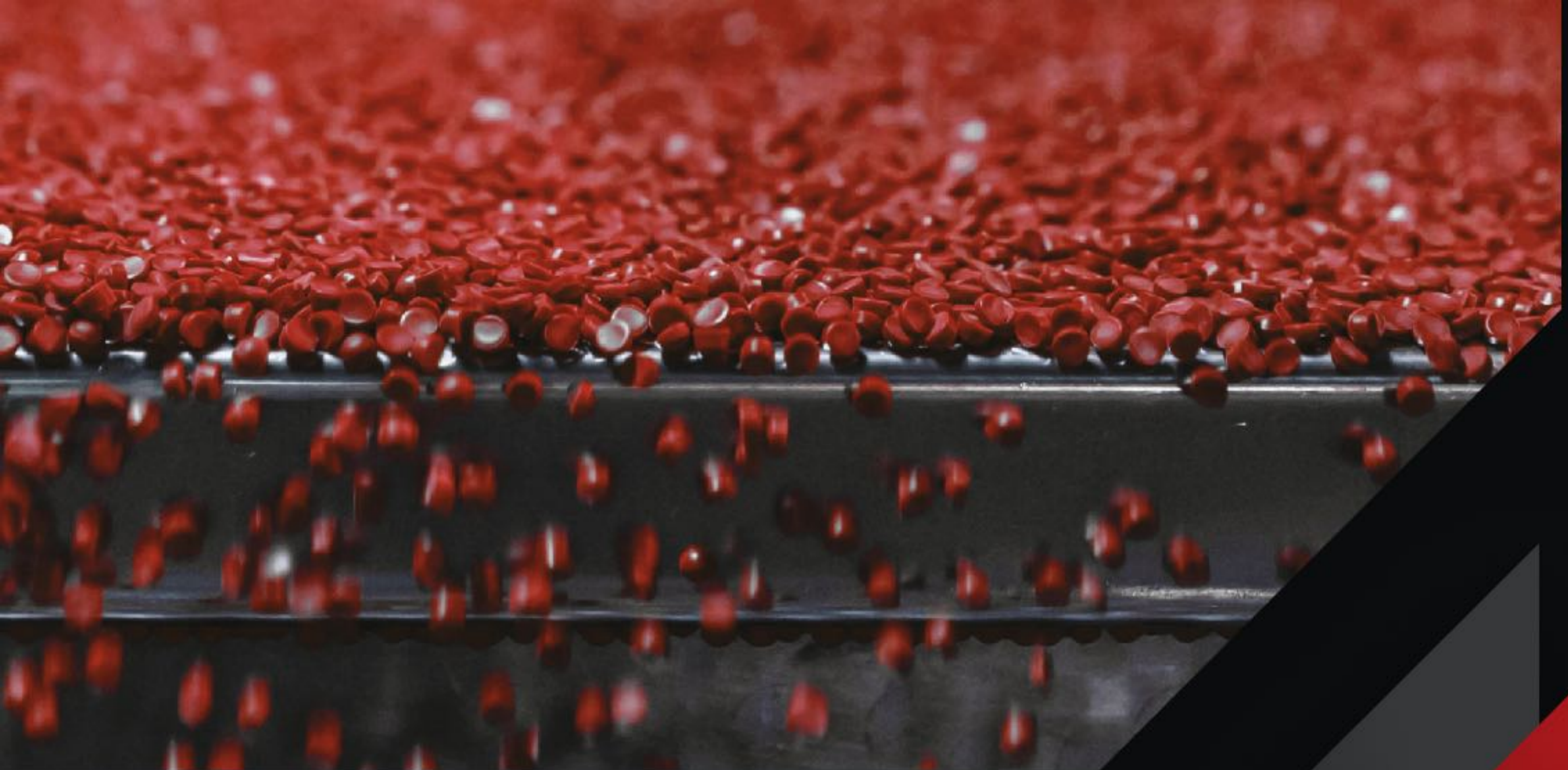
Company History

Granule World Production Company (Private Joint Stock) was established in 1994 on a 17,000-square-meter plot in the Ravand Industrial Town of Kashan. It started operations with one production hall and one production line, in response to the urgent needs of domestic industries and manufacturers, including wire and cable industries, the automotive industry, and others.

With nearly 30 years of experience in producing various types of soft and rigid PVC granules, color Master-Batches based on PVC, HFFR materials, and black jacketing materials based on polyethylene, the company now operates with:

- 3 production halls,
- 11 granule and Master-Batch production lines,
- Advanced laboratory equipment,
- Skilled and dedicated personnel.

The annual nominal capacity of PVC production is 54,000 tons, adhering to the highest quality standards in line with national and international benchmarks.

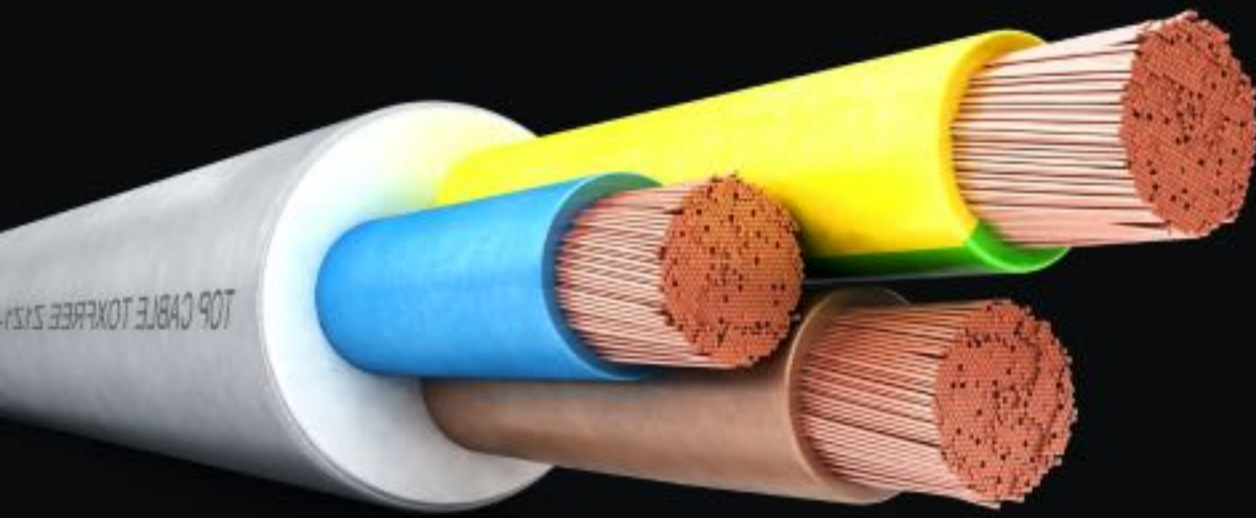


Products

Granule World Company provides four diverse product categories for various industrial applications:

- PVC Granules: Used for insulation of copper and aluminum cables, including power cables, flame-resistant cables, building wires, telecommunication and automotive wires, IT cables, military cables, and acid-resistant low-smoke flame-retardant compounds.
- Filler Granules: Designed for wire and cable industries.
- Master-Batches: Used in rubber, plastic, home appliances, and wire and cable industries.
- Polyethylene-based Insulating, Coating, and Filler Granules: Including HFFR (Halogen Free Flame Retardant), Black Jacketing, and LSZH (Low Smoke Zero Halogen) compounds.

Introduction to Halogen-Free Cables

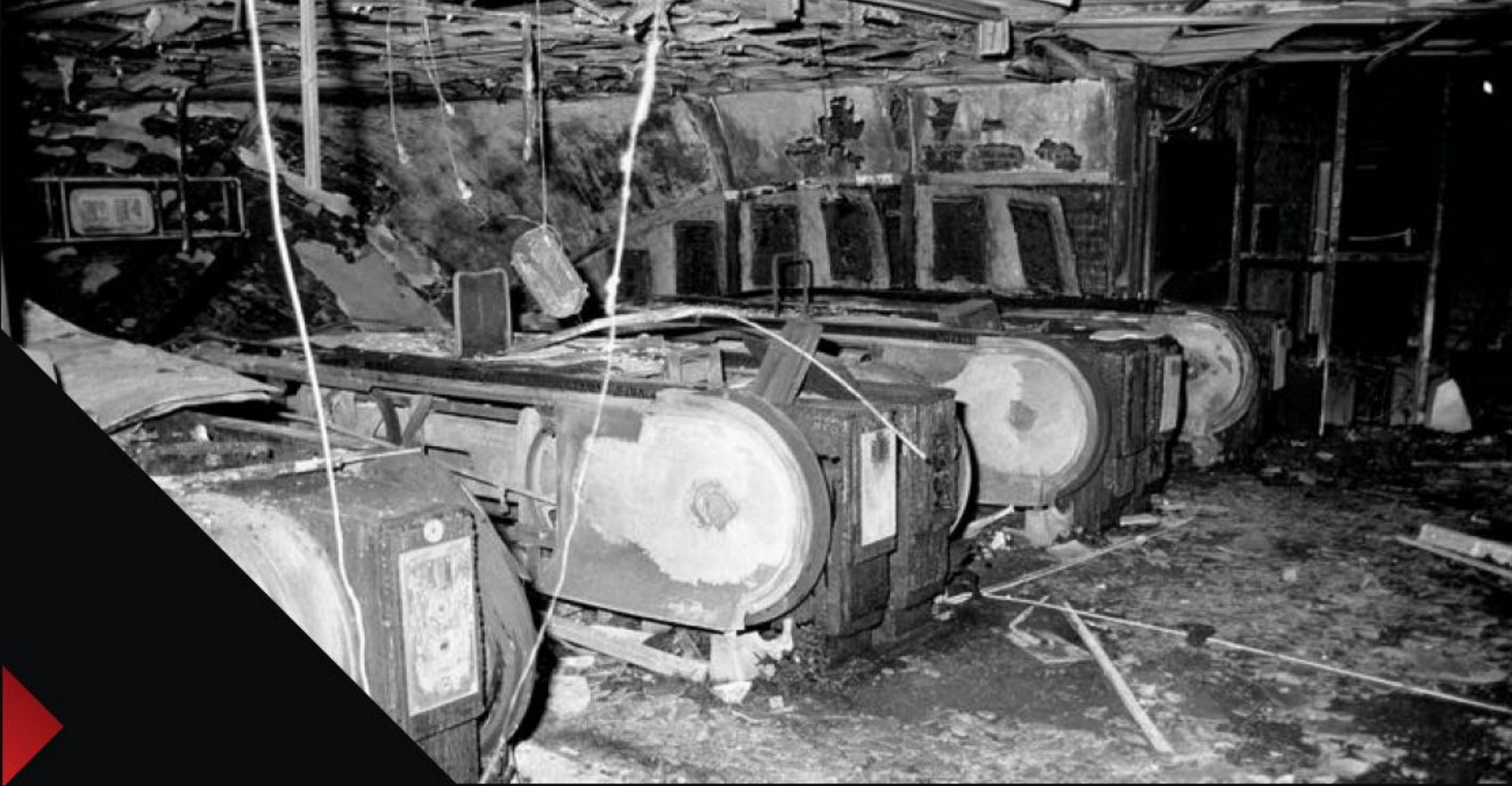


Halogen-free cables are increasingly used for electrical transmission due to their high safety standards against fire and minimal damage in case of incidents.

What are Halogens?

Halogens are non-metallic elements in Group 7 of the periodic table, including fluorine, chlorine, bromine, iodine, and astatine. Combustion of halogen-containing compounds releases highly toxic gases that can cause poisoning or death upon inhalation. They can also damage electrical and electronic equipment.





History of Halogen-Free Cables

One of the most notable fire incidents occurred in London's subway station in 1987, resulting in 32 fatalities.

Investigations revealed that most deaths were caused by toxic gases and smoke from burning PVC-insulated cables.

Following this, the use of halogen-containing cables in the London subway system was prohibited, leading many industries to adopt halogen-free cables.



Halogen-free cables are widely used in:

- Telecommunication centers
- Broadcasting stations
- Public spaces such as road tunnels, subways, elevators, conference halls, cinemas, theaters, shopping centers, hospitals, airports, military facilities, and fire alarm systems.



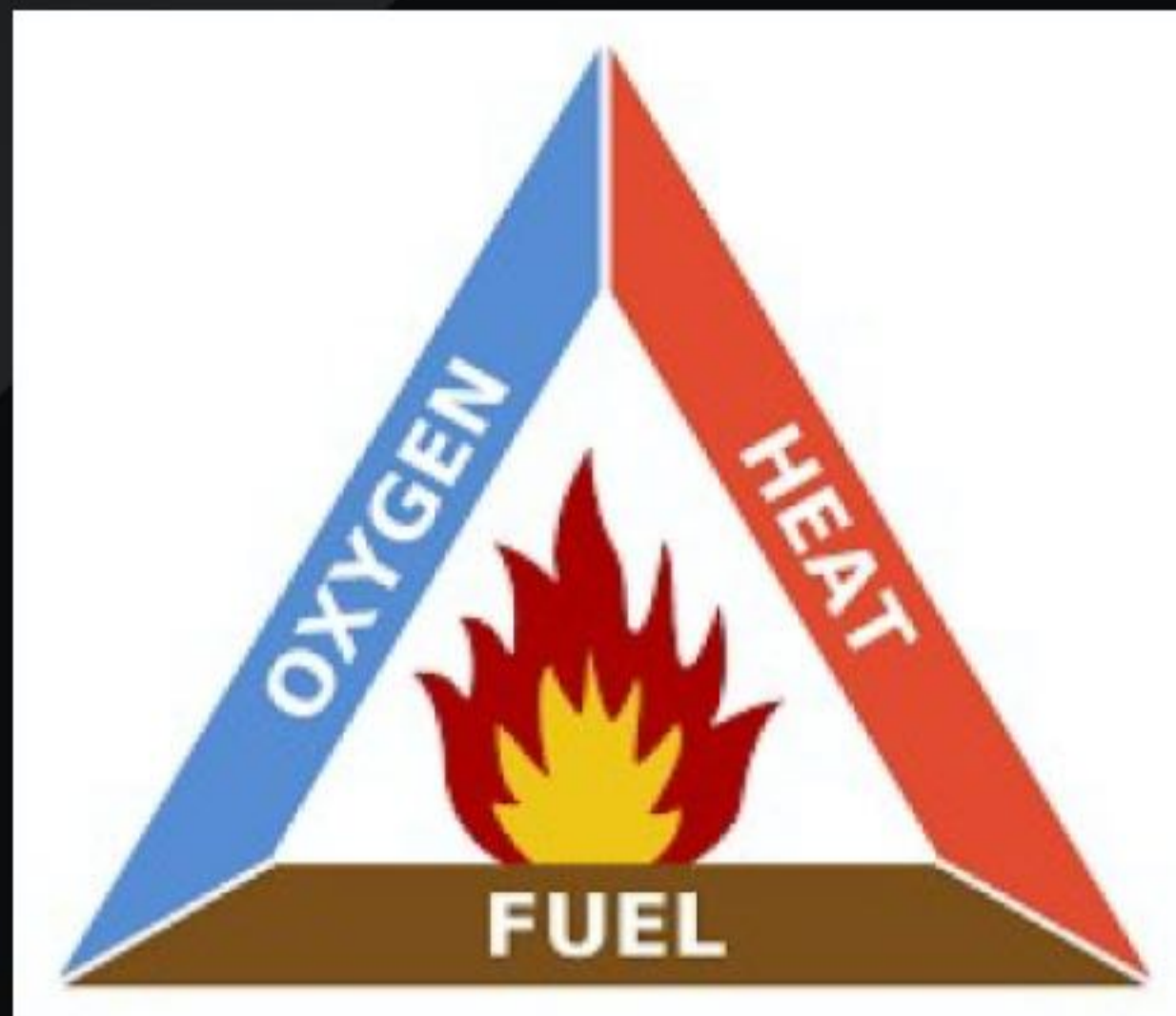
Halogen-Free Materials for Cables:

Common halogen-free materials include EVA, PE, PP, and others.

Fire Safety and Damage Mitigation

During a fire, halogen-containing materials release corrosive gases that can damage (electronic) equipment. This is especially crucial in communication centers and data facilities.





Flame Retardant Mechanisms

The fire triangle consists of three elements: fuel, heat, and oxygen. Fire can be prevented by eliminating at least one of these elements.

There are three mechanisms to extinguish flames:

- Charring Layer Formation: Forms a charred layer that blocks heat and oxygen.
Examples: Antimony oxide, melamine polyphosphate.
- Flame Smothering: Produces denser-than-air gases that reduce oxygen around the flame.
Examples: PVC and halogen-containing materials.
- Thermal Quenching: Releases water to lower the surface temperature of the material.
Examples: ATH (Aluminum Hydroxide), MDH (Magnesium Hydroxide).



HFFR Materials

Halogen Free Flame Retardant compounds contain EVA, PE, ATH, magnesium hydroxide, and other additives.

ATH prevents flame spread by releasing water during combustion, visible as bubbles on the cable surface.

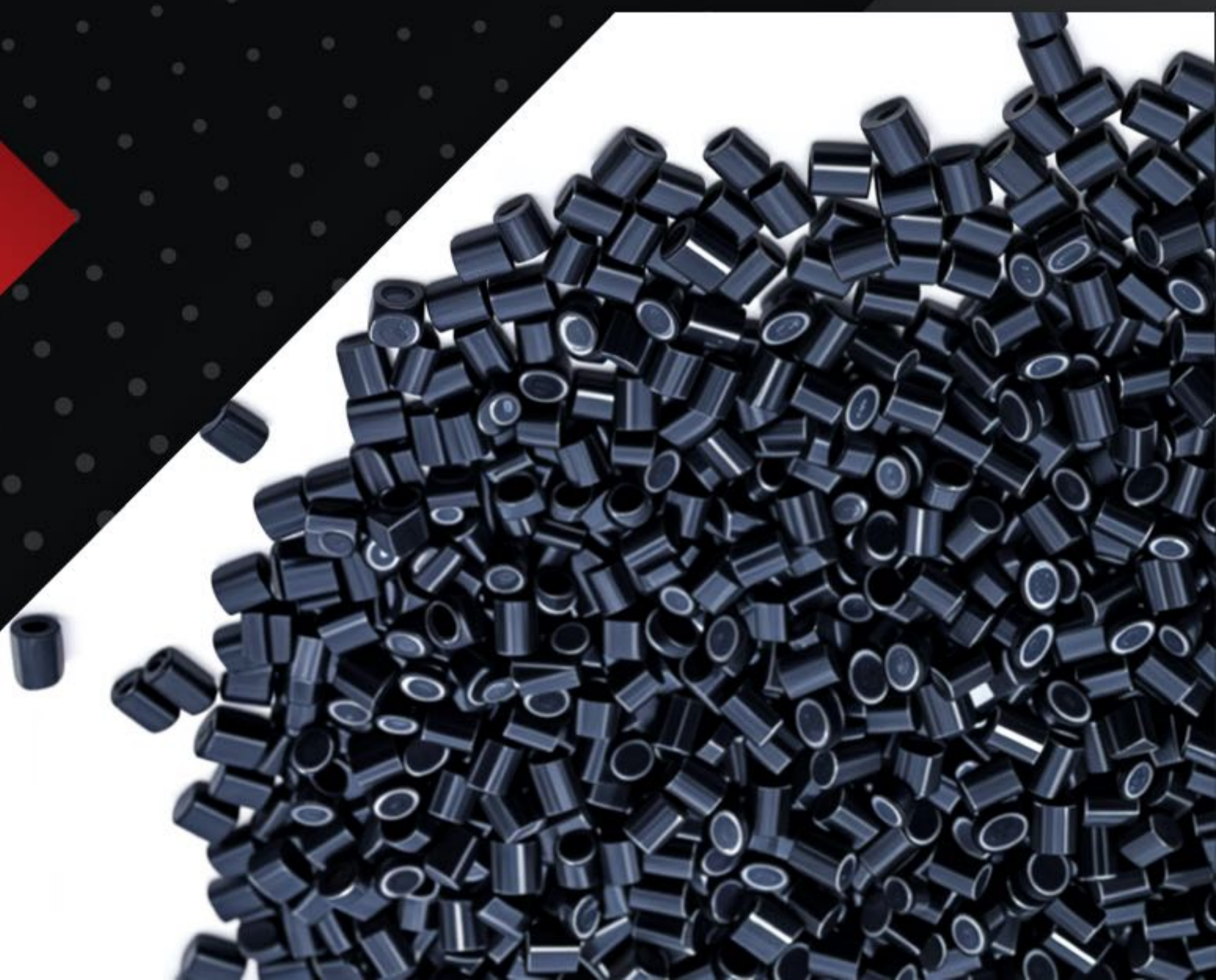
To ensure the effectiveness of these materials, several international tests are conducted:

1. Vertical Flame Test (IEC 6332-1)
2. Flame Propagation Test (IEC 6332-3)
3. Smoke Density Test (IEC 61034-1/2/VDE 0472 PART 816)
4. Halogen Content Test (IEC 60754-2)
5. Oxygen Index Test (ASTM D2863)

Polyethylene Insulation and Coating for Cables

Modern communication networks require cables that are reliable, consume minimal raw materials, and provide high quality and durability. Polyethylene coatings are increasingly used in telecommunication cables, fiber optics, and power cables due to their excellent mechanical and chemical stability.

Granule World offers cutting-edge polyolefin-based compounds to meet these demands, leveraging advanced production technologies and localized formulations.



Product Groups

○ Polyethylene Insulation

HDPE, MDPE, LDPE, LLDPE insulations for telecommunication, coaxial, and network cables as per global standards.

Type: I, II and III

Class: A, B or D

Category: 3, 4 or 5

Grade: E1-11

○ Polyethylene Coatings

HDPE, MDPE, LDPE, LLDPE coatings for telecommunication and power transmission cables.

Type: II , III and IV

Class: C or D

Category: 3, 4 or 5

Grade: J1-5



○ Polypropylene Insulation

For fiber optics and network cables, offering superior mechanical, electrical, and thermal properties.

○ Polyethylene Fillers

Lightweight fillers that do not adhere to PVC insulation and coatings, reducing production costs and increasing efficiency.



Specifications table for HFFR blends for wire and cable applications


Application	Elongation at break (%)	Tensile strength (MPa)	Hardness (Shore D)	Density (gr/cc)	LOI (%)	MFI (150 c/ 21.6Kg) gr/10min	Reference Standard	Product Group	Product Code	Row
General Insulation Blends	min175	min11	53±1	1.43±0.01	32	2.5±1	IEC 60502-1 ST8 VDE 0207	HFFR	HFF-19	1
General Coating Blends	min180	min11	52±1	1.43±0.01	32	2±1	IEC 60502-1st8 VDE 0207	HFFR	HFF-18	2
Economical Filler Blends	min200	min5	45±1	1.52±0.01	39	16±0.5	IEC 60502-1 VDE 0207	HFFR	PE-9	3
LSZH Coating Blend	min220	min9	47±1	1.41±0.01	37	10±0.5	IEEEE802	HFFR	LSZH-6	4

Technical specifications table for some polyolefin blends

Application	Elongation at break (%)	Tensile strength (MPa)	Carbon black Content (%)	Density (gr/cc)	MFI (190 c/ 2.16Kg) gr/10min	Reference Standard	Product Group	Product Code	Row
jacket for telecommunication cable	min500	min18	2.5±0.2	0.96	0.7±0.2	IEC 60502-1 ST3 ASTM D1248	HDPE Jacket	HD07B	1
jacket for telecommunication cable	min400	min14	2.5±0.2	0.93	0.9±0.2	IEC 60502-1 ST3 ASTM D1248	LDPE Jacket	LD10B	2
internal sheath for Power cable	min350	min16	2.5±0.2	0.94	4.0±0.5	ASTM D1248	MDPE Jacket	MD40B	3
insulation for telecommunication Cable	min550	min14	-	0.95	0.7±0.2	ASTM D1248	HFHDPE insulationFR	HD07N	4
insulation of vehicle and fiber optic Cable	-	min25	-	0.91	3.5±0.5	ISO 6722-1 IEC60794	PP insulation	CP35N	5
Filler for PVC insulation and Jacket Compound	min200	-	-	1.2	18	IEC 60227 IEC 60502	PE Filler	FPE08N	6



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