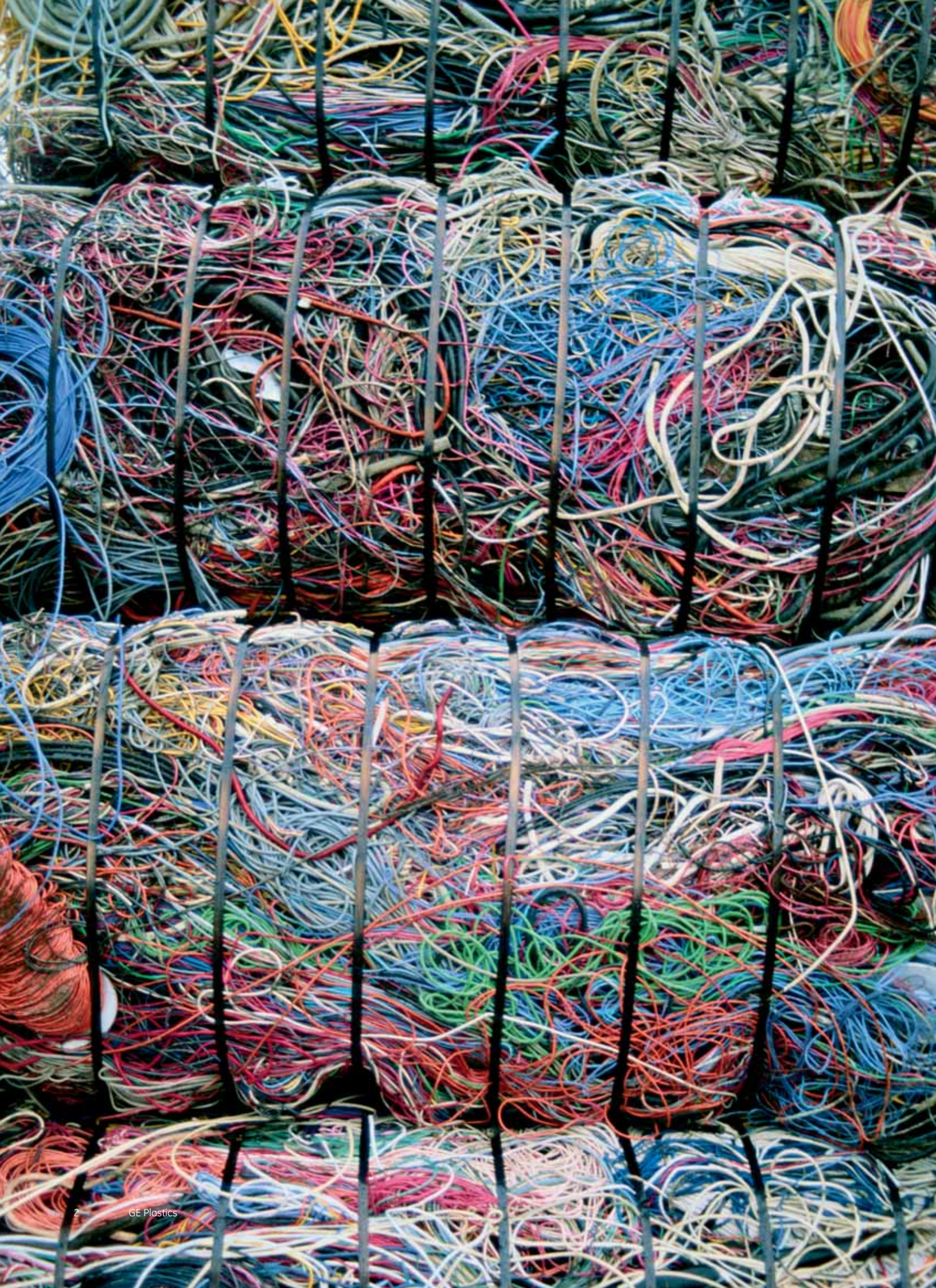
GE
Plastics

There is a better choice.

Noryl* non-halogenated, flame-retardant, flexible wire-coating resins

GE imagination at work



Out with the old.

Because wire and cable is often tucked out of sight, it is easy to ignore the sheer volume of its application in our lives. Yet this volume is what makes the disposal and recycling of wire and cable such an increasingly pressing environmental issue.

Ecologically minded consumers and government bodies have put increasing pressure on wire and cable manufacturers to phase out conventional PVC wire coatings that can release toxins during incineration. Many materials such as XLPE resins cannot be recycled at all.

Yet the industry continues to use these materials, because most alternatives lack PVC's performance.

Clearly, the status quo needs to change.

In with Noryl* resin.

GE offers a new solution: Noryl modified polyphenylene ether resins. These thermoplastics with the potential for recyclability can deliver PVC's flexibility and processing performance with the added benefits of low specific gravity and improved abrasion resistance. Plus, since Noryl resins are thermoplastics, they offer a faster-processing, potentially recyclable alternative to highly filled FRPE resins and XLPE materials.

Flexible Noryl wire coating resins also provide non-halogenated, non-brominated, lead-free flame resistance – an increasingly important quality for consumer electronics applications.

The true value of GE's innovative wire coating material becomes evident in how it meets changing consumer and government demands, while preserving the status quo on the manufacturing floor. Many wire coating manufacturers will find that Noryl resin is compatible for use in similar extruders used to process PVC and other conventional materials.

Lighter Materials
As consumers demand more sophisticated and feature-loaded electronics, designers must scrutinize every component to determine if it can be made smaller and lighter. Now, advanced resin technology from GE has expanded opportunities for creating thin- and ultra-thin wire coating with performance similar to polyvinyl chloride (PVC),flame retardant polyethylene (FRPE), flame retardant thermoplastic elastomers (FRTPEs), and cross-linked polyethylene (XLPE).

Easier Processing
GE's thermoplastics for flexible wire coating can offer a wider processing window than XLPE materials, enabling easier processing and faster throughput.

Environmental Innovation
The increasing emphasis on environmental concerns such as recyclability has led wire and cable manufacturers to seek innovative new wire coating solutions. GE delivers with several flame-retardant grades that meet halogen-, chlorine-, and lead-free requirements, as well as having the potential for recyclability.

Applications

Automotive

Even though some of today's vehicles carry more than two and a half kilometers of wire, automotive wire coatings have changed little in the past three decades. PVC materials provide the solution for about 60 percent of automotive applications, with XLPE resins bringing enhanced high-heat performance where needed.

Despite the automotive industry's efforts to improve its environmental record, cost and performance have taken precedence in its choice of materials. Consequently, automakers have continued to use PVC and XLPE resins until a more cost-effective, higher-performing alternative appeared.

Now, that alternative has arrived.
The modified polyphenylene ether (mPPO*) thermoplastic resin that constitutes wire coating made from flexible Noryl resin is an inherently lighter, tougher material than PVC. By enabling thinner, stronger wall coatings, Noryl resin could help multiply weight savings in your application, while enabling more compact wire bundles. GE's material offers a lower specific gravity (1.03) than either PVC or XLPE, which means it delivers reduced weight when used in identical wire configurations. Its intrinsic toughness enabled one Tier 1 automotive supplier to develop ultra-thin-wall cable insulation designed to reduce overall vehicle wire weight by as much as 25 percent.

Wire coated with certain flexible Noryl resin can meet the requirements for ISO 6722 Class A, B, and C wire heat aging, and exhibits pinch and abrasion resistance that is up to 10 times better than wire coatings made from PVC. These high-performance materials also offer easier processing and faster throughput than XLPE, because they do not require cross-linking.

Wire coating made from flexible Noryl resin has the additional benefit of a lower environmental impact. Compared to PVC, GE's material provides non-halogenated flame resistance, and won't release dioxins when burned. Unlike XLPE resins – which are effectively thermoset materials – wire coating made from flexible Noryl resin can be easily reclaimed, reground and has the potential for recyclability like many other thermoplastics.

Consumer Electronics Solutions

From cell phones to refrigerators, consumer electronics have relied for decades on flame retardant PVC and polyethylene-based wire coating. Recently, the potential environmental and health hazards of these materials have become more and more evident. In addition to the toxins released when halogenated and/or brominated wire coatings burn, many conventional wire coatings may also contain potentially carcinogenic plasticizers.

In response, legislative bodies from Europe to Asia have launched initiatives calling for wire coatings that meet halogen and heavy metal free requirements. Some flame-retardant polyethylene materials already pose compliance issues in Europe. Although PVC wire coating hasn't been banned, the industry expects it will be heavily regulated in the coming years.

Non-halogenated, flame-retardant flexible Noryl resin for wire coating is non-brominated, meets heavy metal free requirements, and has the potential to be recycled. In addition to meeting existing regulations, such as RoHS and WEEE, the material has certifications under UL1581 specification for 80°, 90°, and 105° C. Plus today, several customers are already testing flexible Noryl resin wire and have acquired style pages with the UL758 standard.

Also important:
Noryl resin can typically deliver comparable or better processing performance as conventional wire coating materials and halogen-free alternatives. And it can be extruded on existing equipment with little or no investment under appropriate conditions.

Hot Wiring the Future

GE is committed to continued development of advanced wire coatings. Alongside flexible Noryl resin wire coating technology, we also offer Siltem* STM 1500 resin, a high-heat PEI/Siloxane copolymer based on GE's Ultem* polyetherimide resin. Siltem resin is non-halogenated, generates very low smoke when burned, and exhibits low corrosivity and toxicity – all qualities essential for plenum and other infrastructure applications. Together, these and other advanced GE material technologies open new opportunities for innovative wire coating applications.

Flexible Noryl Resin Properties

Properties	Unit	Standard	WCD801A	WCD861A	WCD891A	WCD931	WCA105	WCV072
Mechanical								
Hardness	Shore A	ASTM D 2240	80	86	89	93	56(D)	72(D)
Tensile Stress at Break	MPa	ASTM D 638	12	15	12	17	23	41
Tensile Strain at Break	%	ASTM D 638	120	100	239	90	85	83
Flexural Modulus	MPa	ASTM D 790	80	150	210	420	650	1550
Electrical								
Volume Resistivity (100V)	Ohm-cm	IEC 60093	3.80e15	5.50e15	5.25e15	9.23e15	3.94e16	1.25e17
Dielectric Strength	kV/mm	IEC 60243	23	23	25	25	26	38.5
Dissipation Factor	1MHz	IEC 60250	0.004	0.004	0.017	0.013	0.0038	0.001
Physical								
Specific Gravity	—	ASTM D 792	1.1	1.1	1.08	1.10	1.03	1.03
Flame	—	VW-1 UL1581	Pass	Pass	Pass	Pass	Pass	(ISO6722 pass)

Flame may differ depending on wall thickness. For further infomation, please contact GE Plastics engineers.

Advanced Performance

For nearly half a century, GE has been developing leading-edge thermoplastic resins. Today, we offer one of the most comprehensive selections of engineering materials and technical support for OEMs and suppliers worldwide.

Our portfolio of advanced materials and expertise offers industry-leading solutions and technical support to wire and cable manufacturers. We continue to address critical performance functions in this market, such as enhancing design flexibility, bringing new products to market faster, and lowering costs.

Performance, however, is only one factor by which consumers judge quality. GE realizes that wire and coating manufactures expect and deserve materials that deliver consistent and reliable performance over the typical lifecycle of their products. We go one step further by providing excellent field technical support, a variety of online tools, and manufacturing excellence to help ensure new designs will endure.

Global Supply

With over 80 manufacturing, technology and joint venture facilities, coupled with application development specialists worldwide, GE can help wire coating designers and manufacturers meet their production deadlines on time and on target. Our dedicated process development wire lines in China and Japan can help customers optimize parameters such as processing line speed, extruder temperatures, and down-stream equipment. These investments translate into significant benefits for our customers.

Serving customers around the world.

With over 15,000 employees at 80 locations in 21 countries, GE Plastics has the global reach to find innovative solutions and create growth opportunities for customers around the world. Global Research Centers and Global Application Technology Centers in the U.S., India, China, Japan, Germany, and the Netherlands spearhead our commitment to developing new ideas and leveraging them in innovative materials for our customers.

Global Employees

80 Locations worldwide includes manufacturing, technology, and joint-venture sites in 21 countries.

Global Manufacturing Sites

Selkirk, New York, USA
Campinas, Brazil
Bergen op Zoom, The Netherlands
Moka, Japan
Shanghai, China
Rayong, Thailand

Global Application Technology Centers

Southfield, Michigan — Application Development Center
Pittsfield, Massachussets — Polymer Processing Development Center
Bergen op Zoom, The Netherlands — European Processing Center
Munich, Germany — Europe Technology Center
Shanghai, China — China Technology Center
Bangalore, India — Welch Technology Center
Moka, Japan — Moka Technology Center

Americas Headquarters:
GE Plastics
One Plastics Avenue
Pittsfield, MA 01201
USA
T: 413 448 7110
F 413 448 5573

European Headquarters:
GE Plastics
Plasticslaan 1
PO Box 117
NL - 4600 AC Bergen op Zoom
The Netherlands
T: +31 164 292911
F: +31 164 292940

Pacific Headquarters:
GE Plastics
1468 Nanjing Road (W)
26th Floor, United Plaza
200040 Shanghai
China
T: +86 21 3222 4500
F: +86 21 6289 8998

Email: gelit@ge.com
geplastics.com

DISCLAIMER: THE MATERIALS, PRODUCTS AND SERVICES OF THE BUSINESSES MAKING UP THE PLASTICS BUSINESS UNIT OF GENERAL ELECTRIC COMPANY, ITS SUBSIDIARIES AND AFFILIATES, ARE SOLD SUBJECT TO ITS STANDARD CONDITIONS OF SALE, WHICH ARE INCLUDED IN THE APPLICABLE DISTRIBUTOR OR OTHER SALES AGREEMENT, PRINTED ON THE BACK OF ORDER ACKNOWLEDGMENTS AND INVOICES, AND AVAILABLE UPON REQUEST. ALTHOUGH ANY INFORMATION, RECOMMENDATIONS, OR ADVICE CONTAINED HEREIN IS GIVEN IN GOOD FAITH, GE'S PLASTICS BUSINESS MAKES NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, (i) THAT THE RESULTS DESCRIBED HEREIN WILL BE OBTAINED UNDER END-USE CONDITIONS, OR (ii) AS TO THE EFFECTIVENESS OR SAFETY OF ANY DESIGN INCORPORATING ITS PRODUCTS, MATERIALS, SERVICES, RECOMMENDATIONS OR ADVICE. EXCEPT AS PROVIDED IN GE'S PLASTICS BUSINESS' STANDARD CONDITIONS OF SALE, GE'S PLASTICS BUSINESS AND ITS REPRESENTATIVES SHALL IN NO EVENT BE RESPONSIBLE FOR ANY LOSS RESULTING FROM ANY USE OF ITS MATERIALS, PRODUCTS OR SERVICES DESCRIBED HEREIN. Each user bears full responsibility for making its own determination as to the suitability of GE's Plastics business' products, materials, services, recommendations, or advice for its own particular use. Each user must identify and perform all tests and analyses necessary to assure that its finished parts incorporating GE's Plastics business' products, materials, or services will be safe and suitable for use under end-use conditions. Nothing in this or any other document, nor any oral recommendation or advice, shall be deemed to alter, vary, supersede, or waive any provision of GE's Plastics business' Standard Conditions of Sale or this Disclaimer, unless any such modification is specifically agreed to in a writing signed by GE's Plastics business. No statement contained herein concerning a possible or suggested use of any material, product, service or design is intended, or should be construed, to grant any license under any patent or other intellectual property right of General Electric Company or any of its subsidiaries or affiliates covering such use or design, or as a recommendation for the use of such material, product, service or design in the infringement of any patent or other intellectual property right.

© 2007 Copyright General Electric Company. All rights reserved.
* PPO, Noryl, Siltem, and Ultem are trademarks of General Electric Company.

GE imagination at work

PLA-771-REV4-0207