



# Sustainable Polyolefin Composites for Today and Tomorrow

Kevin George, Field Development Engineer



# Agenda

- About **GEON**
- Performance Polyolefins
- Sustainable Polyolefin Composites
- RESILIENCE<sup>®</sup> Polyolefin Solutions
- Natural fiber-based Polyolefin Solutions
- Summary & **GEON** Support Overview



# GEON's History

**BF Goodrich** produces the first commercial vinyl polymer, trade named "GEON."

**GEON trade name created**

1927

**PolyOne** is created by merger of M.A. Hanna Co. and The GEON<sup>®</sup> Company.

1997

**GEON<sup>®</sup> acquires Synergistics Industries Limited**, a maker of compounds and plasticizers used in W&C.

**GEON<sup>®</sup> participates in wire and cable market**

2000

**Polyolefins & contract manufacturing added to portfolio**

2013

**2019**

**GEON Performance Solutions**

**SK Capital Partners** purchases the PVC, polyolefins and contract manufacturing business of PolyOne. **GEON<sup>®</sup> Performance Solutions created.**

A leading brand in Polyvinyl Chloride compounds, GEON offers a broad range of formulated Polypropylene & other Thermoplastic Polyolefin products, and Contract Manufacturing services



Headquarters: **Westlake, OH**



**70+ years** compounding expertise



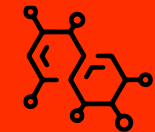
**11** production facilities in North America and China



**1,000+** customers



**1,100** employees



**Engineered polymers:** PVC, PP, PE, TPO, nylons, PCs, ABS + more

# The Markets We Serve / Brands To Rely On



Wire & Cable



Building & Construction



Appliances



Healthcare



Transportation



Automotive



Recreation



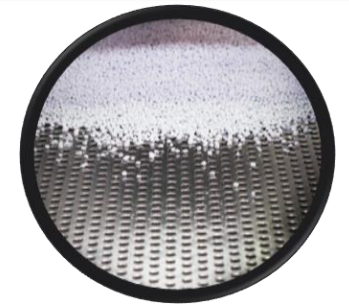
Electrical & Electronics



GEON<sup>®</sup> Flex



GEON<sup>®</sup> Rigid



GEON<sup>®</sup> RESILIENCE<sup>®</sup>



GEON<sup>®</sup> Fiberloc<sup>™</sup>



GEON<sup>®</sup> Plus



GEON<sup>®</sup> Regulated



GEON<sup>®</sup> Lite

# 7 Core Areas of Sustainability





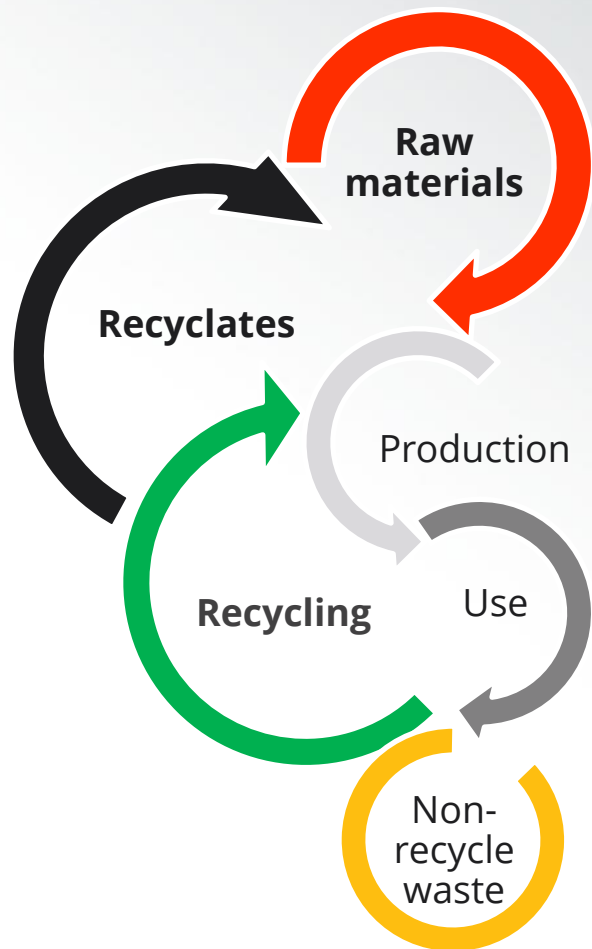
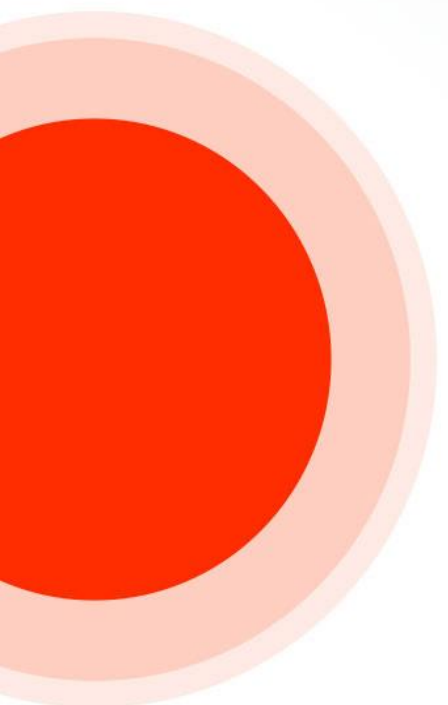
## Compounding and manufacturing side:

- Use fewer virgin resources and less energy, resulting in a smaller carbon footprint
- Work with local recyclers to reduce shipments to landfill
- More aggressive internal sustainability goals, including automation investment
- GEON plant proximity to customer locations



## Material Based Solutions:

- RESILIENCE R – polyolefin compounds that contain recycled content
- Natural Fibers – polyolefin compounds reinforced with bio-based materials



# RESILIENCE R - recycled content in compounds



# Busting Myths



- Rigorous testing of each incoming material batch vs. tight specifications and certificates of analysis (COAs) for recyclates
- Formulation expertise to ensure consistent performance involve additives, fillers, modifiers and agents



- GEON offers virgin equivalents to its extensive portfolio of RESILIENCE R
- Provides an alternative in case of supply disruption



- Strengthen corporate sustainability branding
- Path to end-user OEM initiatives on ESG and regulatory compliance



- Adopting the sustainable option based on use case
- RESILIENCE R equivalency promotes ease of material testing, simulation capabilities and application development services

# Quality Control of Recycled Resin

GEON follows strict protocols for each batch of PIR material used in its RESILIENCE<sup>®</sup> R products, which contain up to 35 percent recycled content. These include:

- No compromise in quality control (QC) standards as compared to prime material
- Evaluation of samples from every lot of incoming recycled material
- Measurement and verification of mechanical properties using recognized industry standards, such as ASTM methods. These include:
  - + Melt flow rate
  - + Ash level
  - + Tensile strength at yield
  - + Flexural modulus
  - + Notched Izod impact
  - + Screening for contamination and issuance of COAs

**RESILIENCE**<sup>®</sup>

Sept. 06, 2023 ACCE

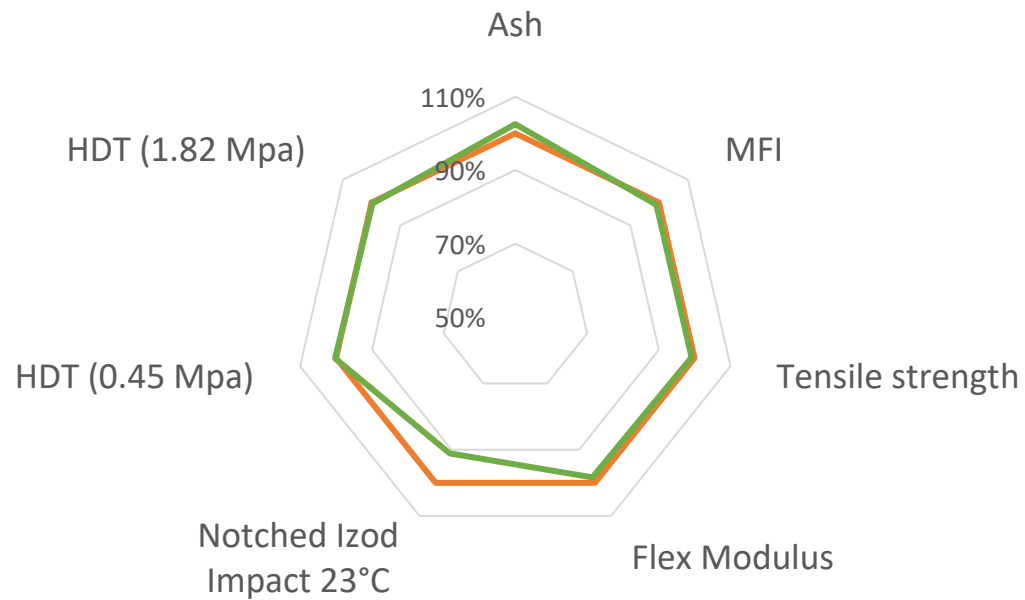
Geon Copyright ©



# Comparative Testing - 20% Talc HPP

20% Talc PRIME VS RECYCLED  
Average Property Values

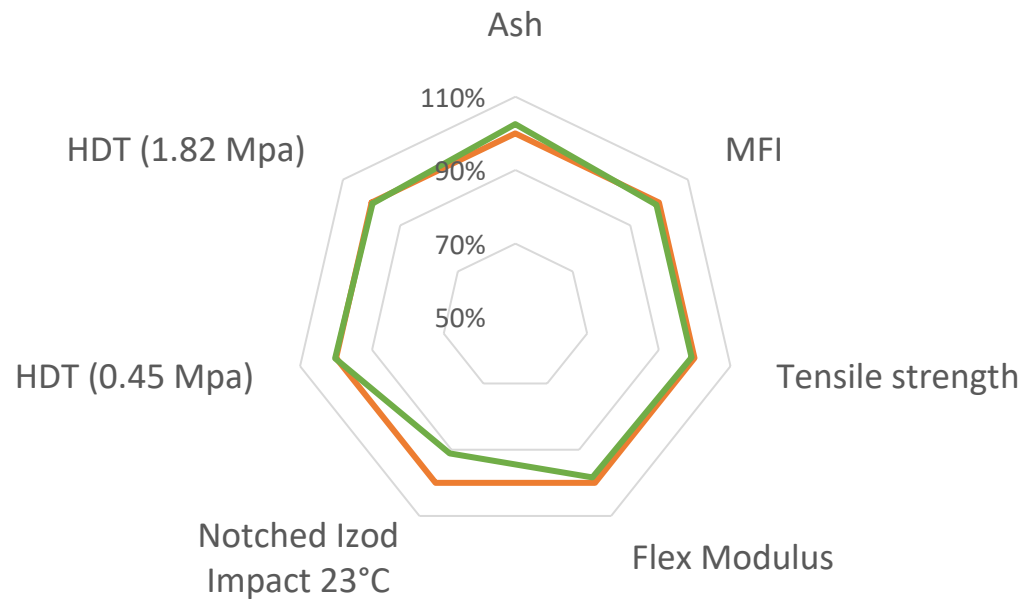
— GEON F5134T2-4 — GEON F5134T2-4R - Recycled



# Comparative Testing - 20% Talc HPP

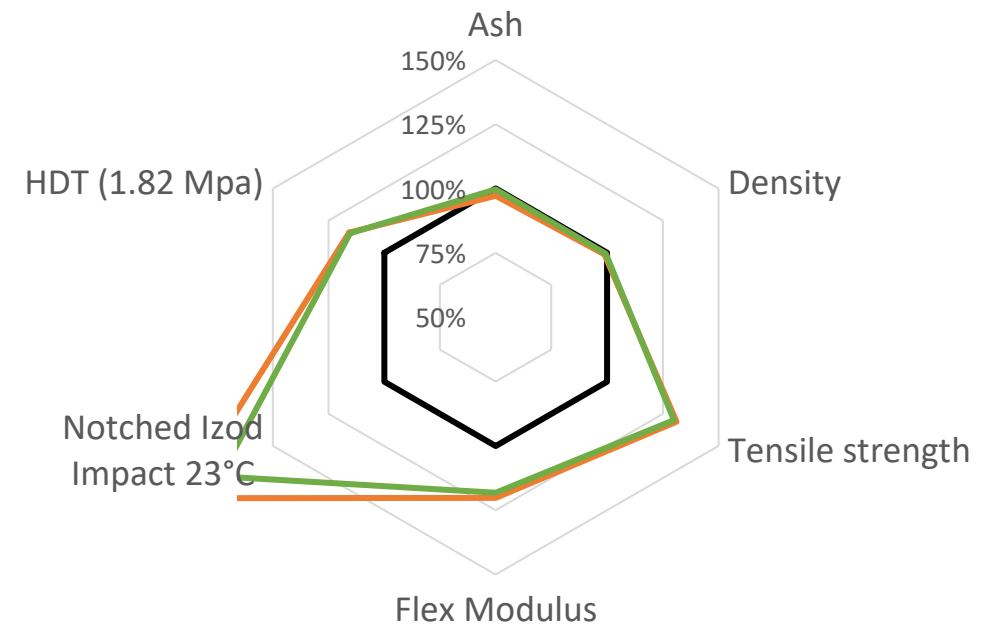
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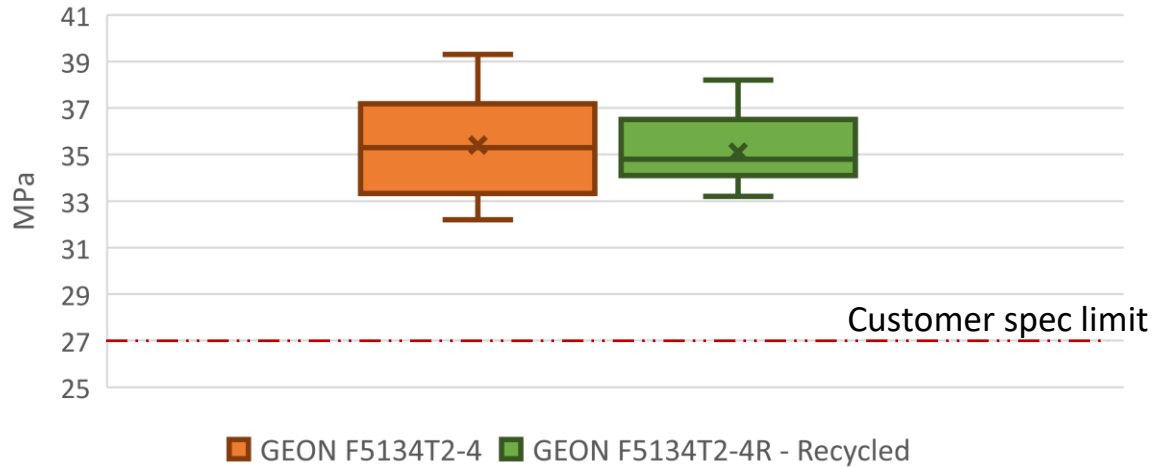
F5134T2-4 PRIME and RECYCLED  
vs. Customer Spec

— Customer Spec — GEON F5134T2-4 — GEON F5134T2-4R - Recycled

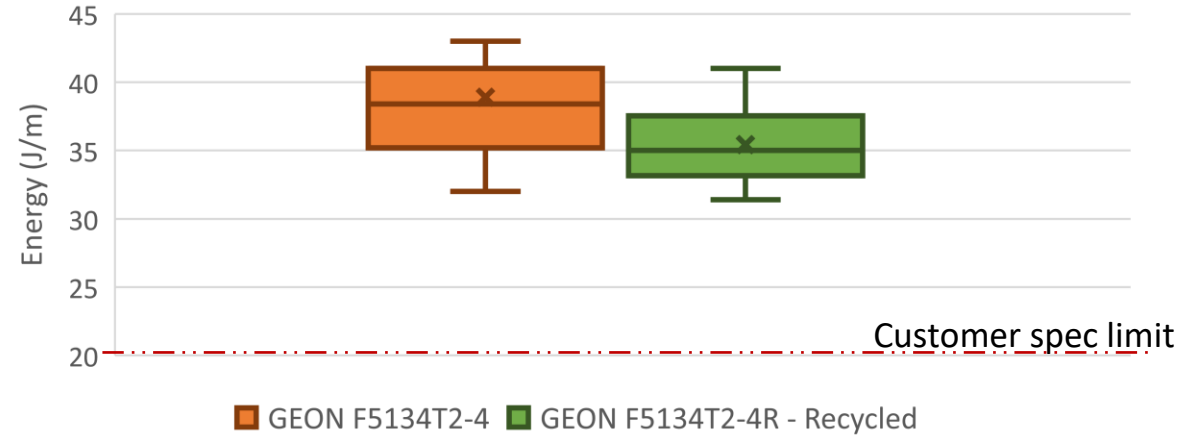


# Comparative Testing - 20% Talc HPP

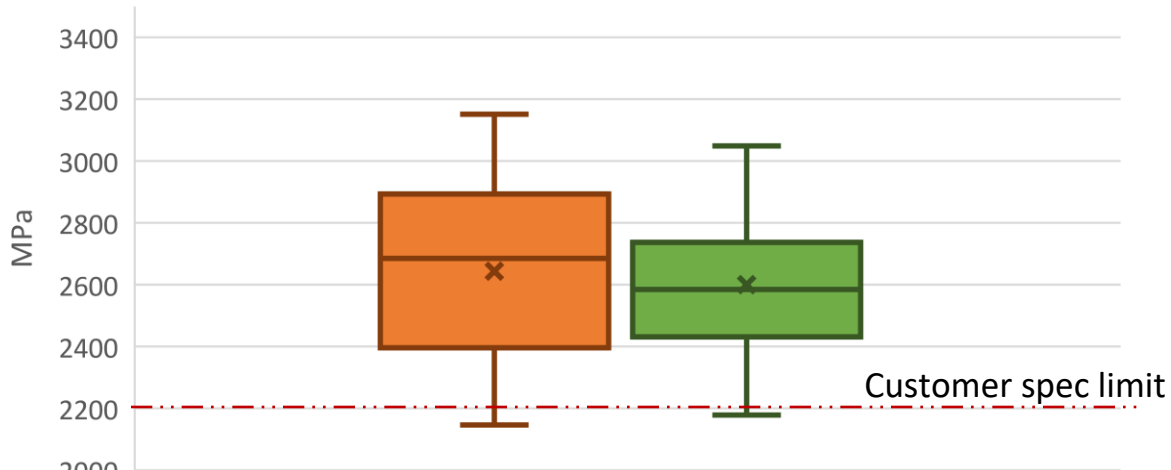
### 20% Talc HPP - Tensile Strength



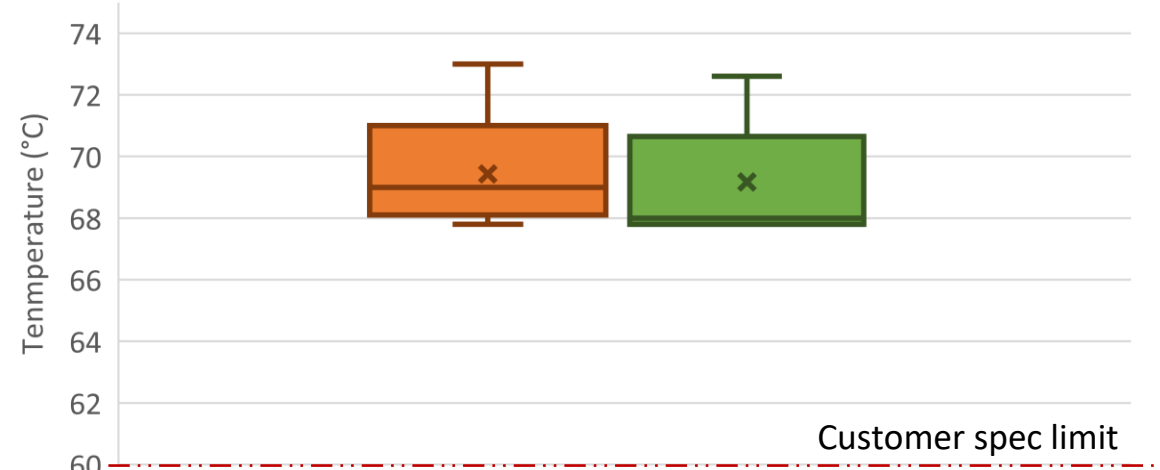
### 20% Talc HPP - Notched Izod Impact



### 20% Talc HPP - Flexural Modulus



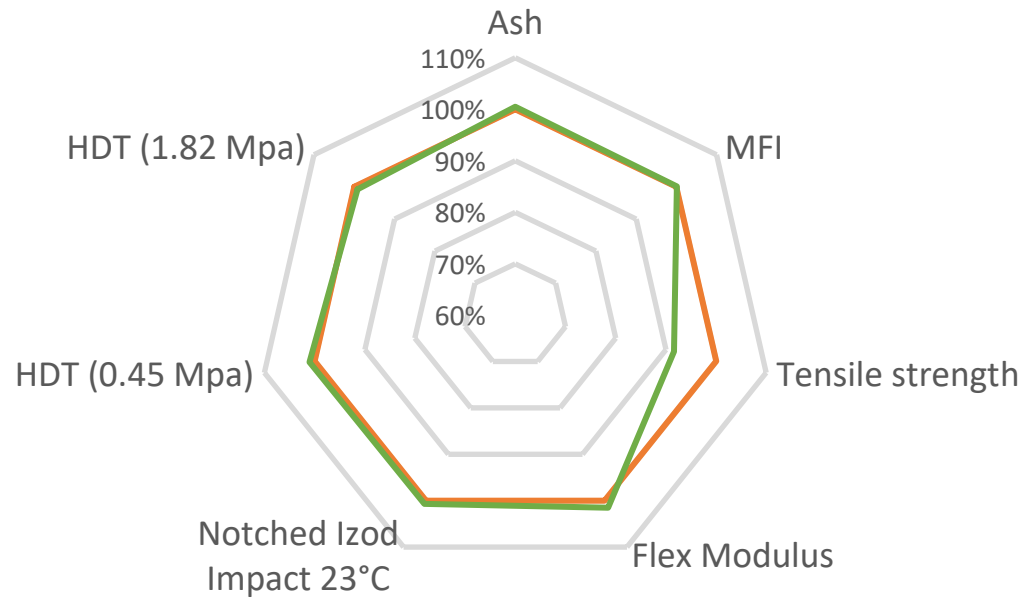
### 20% Talc HPP - HDT (1.82 mpa)



# Comparative Testing - 40% Glass/Mineral HPP

40% Glass/Mineral Filled HPP  
PRIME VS RECYCLED Average Property Values

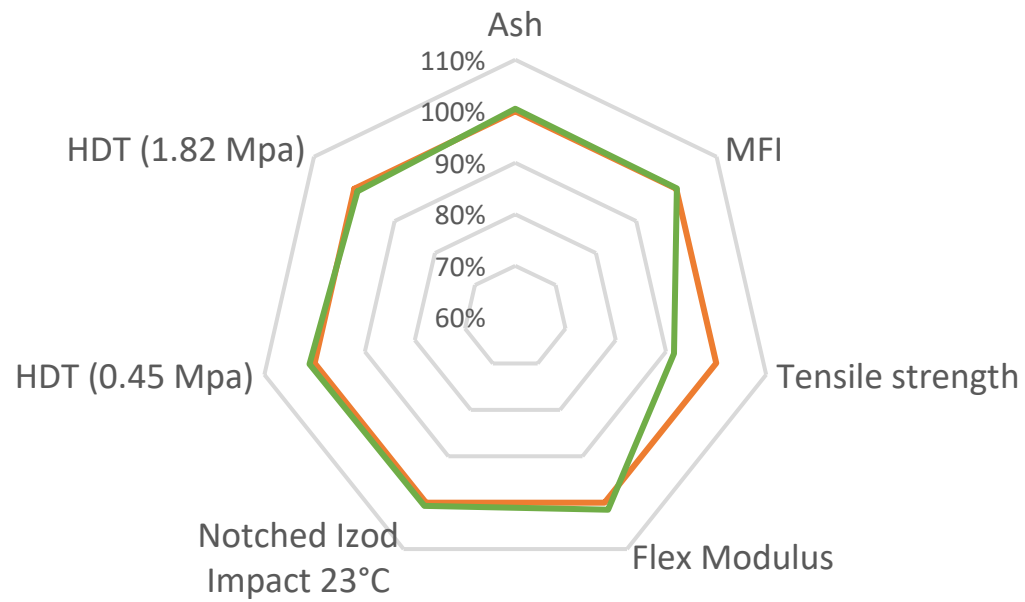
— GEON PP5940 B131 — GEON PP5940R B131 - Recycled



# Comparative Testing - 40% Glass/Mineral HPP

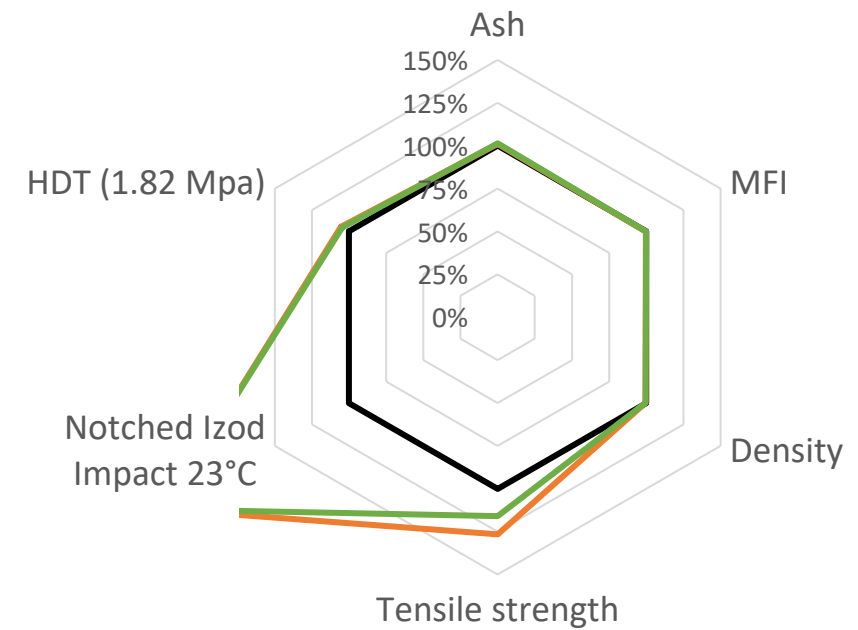
40% Glass/Mineral Filled HPP  
PRIME VS RECYCLED Average Property Values

— GEON PP5940 B131 — GEON PP5940R B131 - Recycled



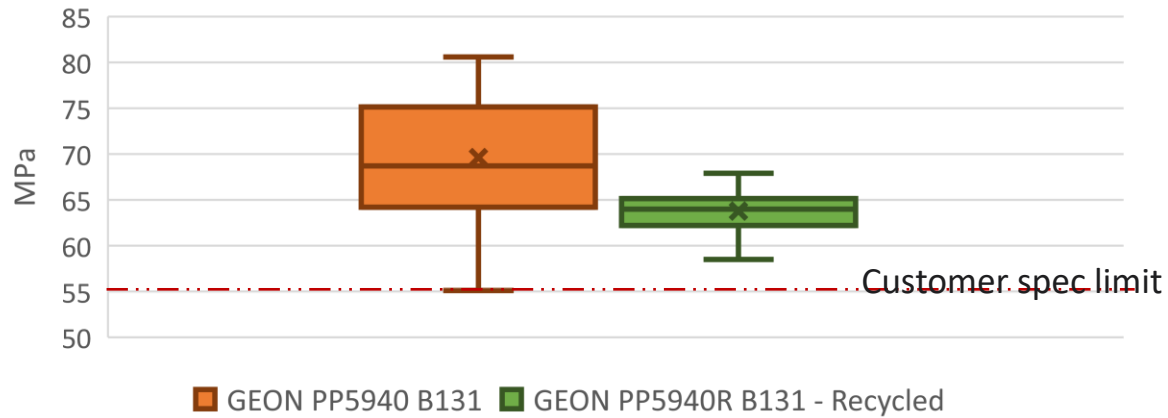
40% Glass/Mineral Filled HPP  
PRIME and RECYCLED vs. Customer Spec

— Customer Spec — PP5940 - Prime — PP5940 - Recycled



# Comparative Testing - 40% Glass/Mineral HPP

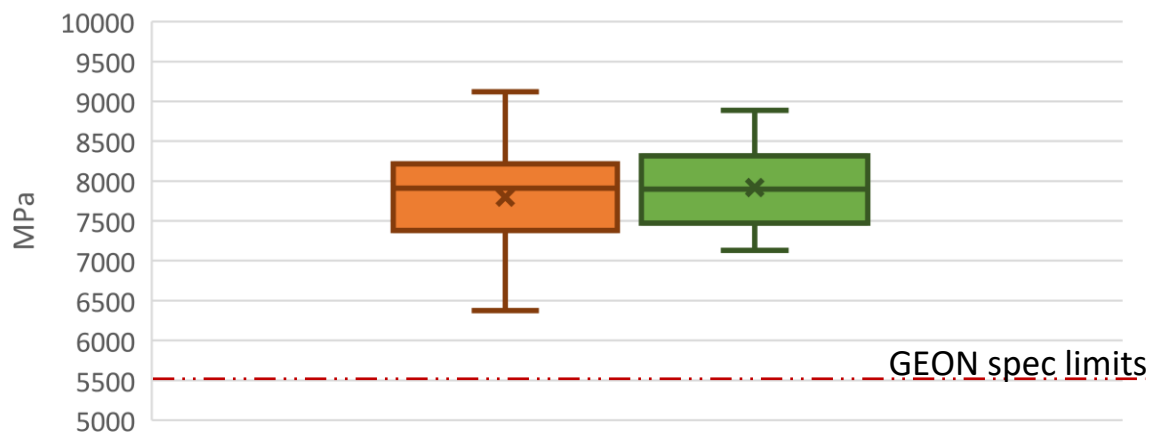
40% Glass/Mineral Filled HPP  
Tensile Strength



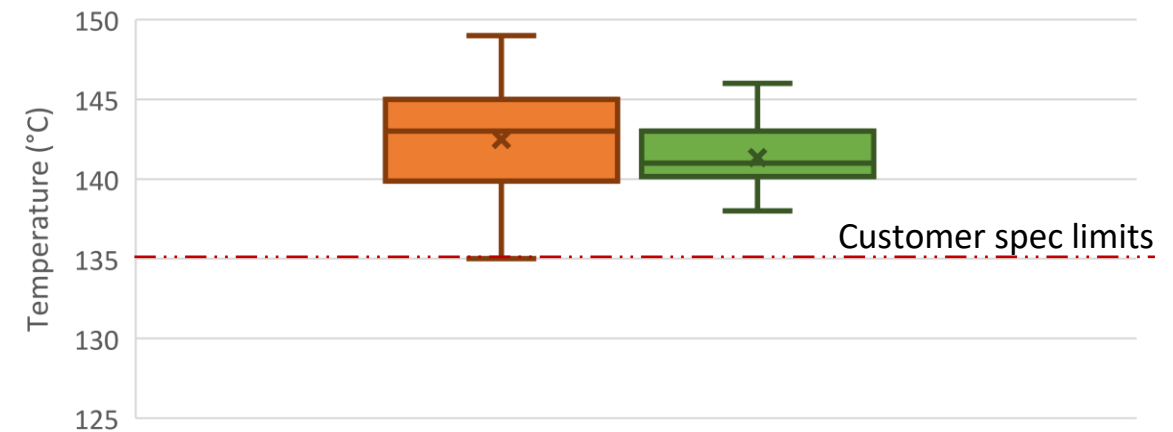
40% Glass/Mineral Filled HPP  
Notched Izod Impact



40% Glass/Mineral Filled HPP  
Flex Modulus



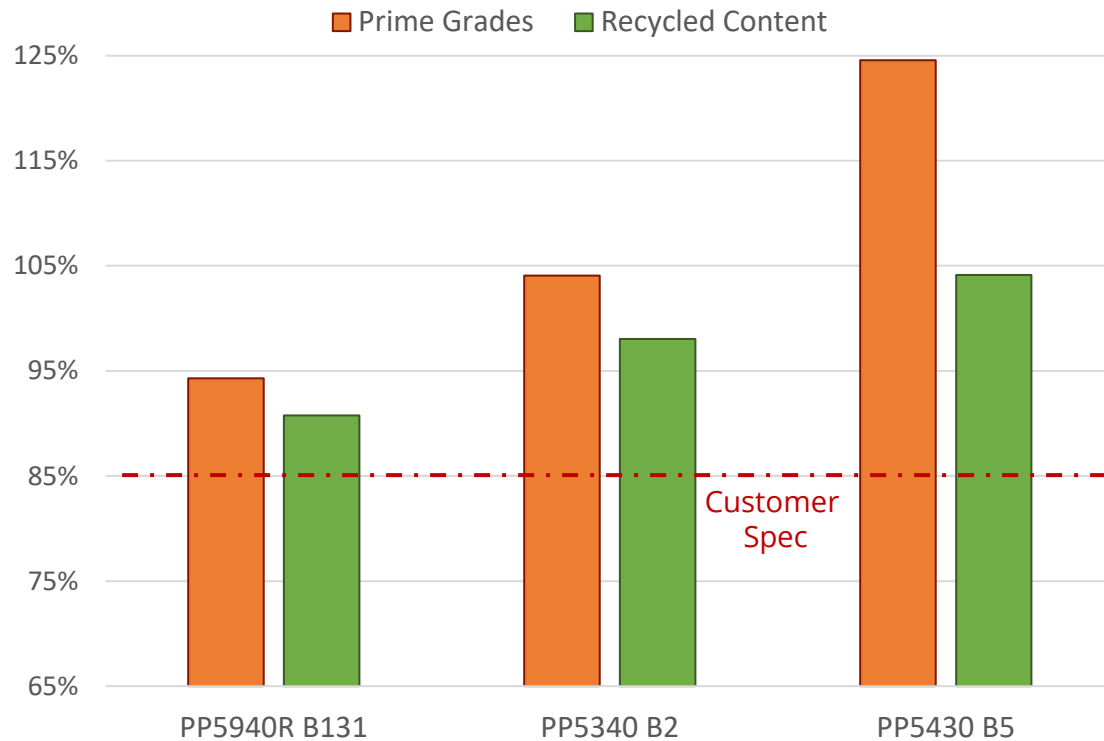
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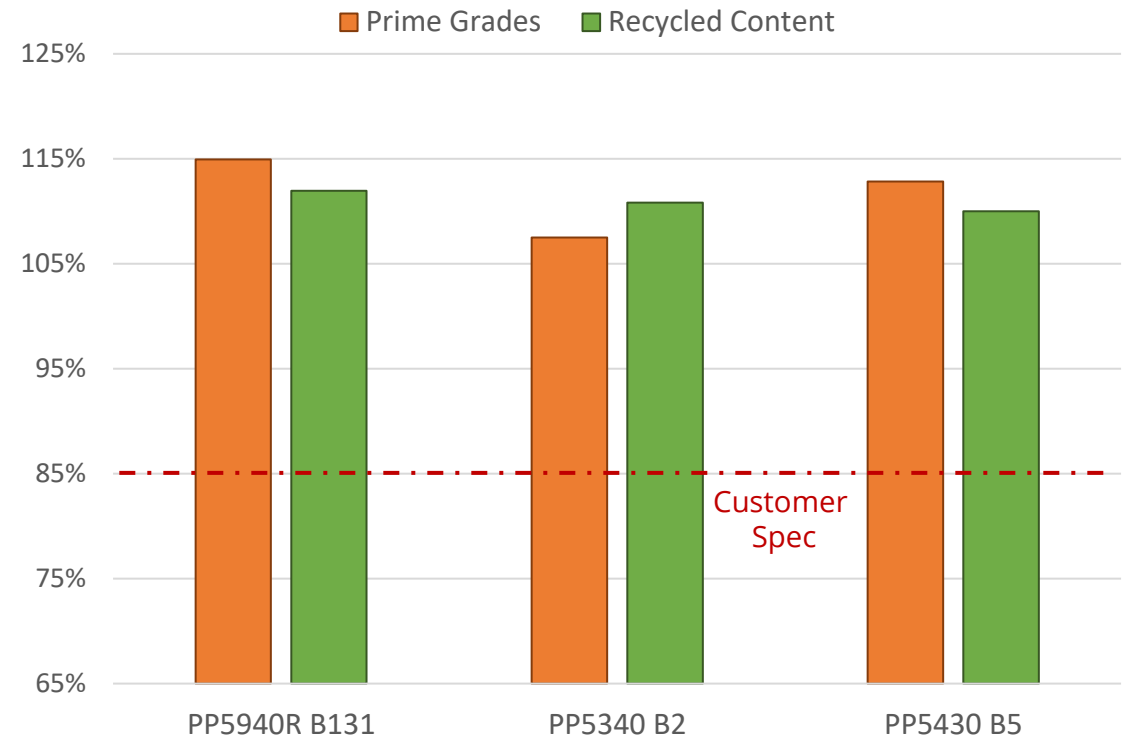


# Long Term – Thermal Stability

Impact Strength % retention  
After 1000 hour at 140°C Aging



Tensile Strength % retention  
After 1000 hour at 140°C Aging



***Physical property testing data shows RESILIENCE R PP grades comparable long-term thermal stability compared to the prime grades of a variety of reinforcement types and levels filled polyolefins***

# Busting Myths



- Shown that we can formulate material with recycled content to have equivalent performance vs their prime offsets



- We have an alternative ready to go in case of supply disruption.



- Path to end-user OEM initiatives on ESG and regulatory compliance



- RESILIENCE R equivalency promotes ease of material testing, simulation capabilities and application development services

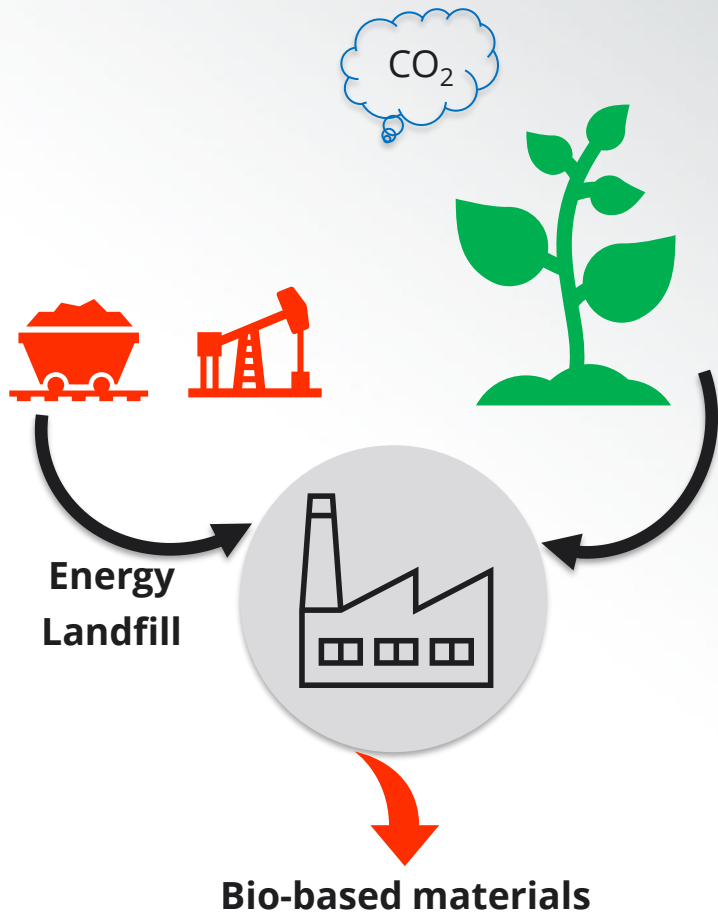
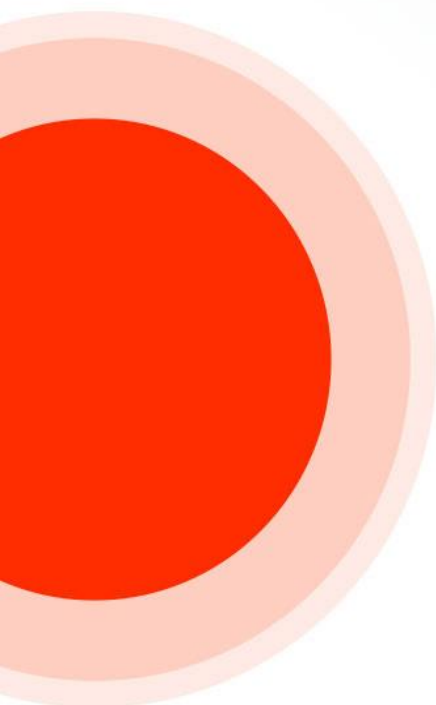


Collaborate and innovate across our value chain

## Portfolio of grades containing recycled streams:

- Variety of reinforcement types and levels available
- Confirmed level of recycled content
- Equivalent virgin grades available
- Physical properties and rheology equivalence to "prime" grades
- Active quality control procedures of incoming raw materials and compounds produced

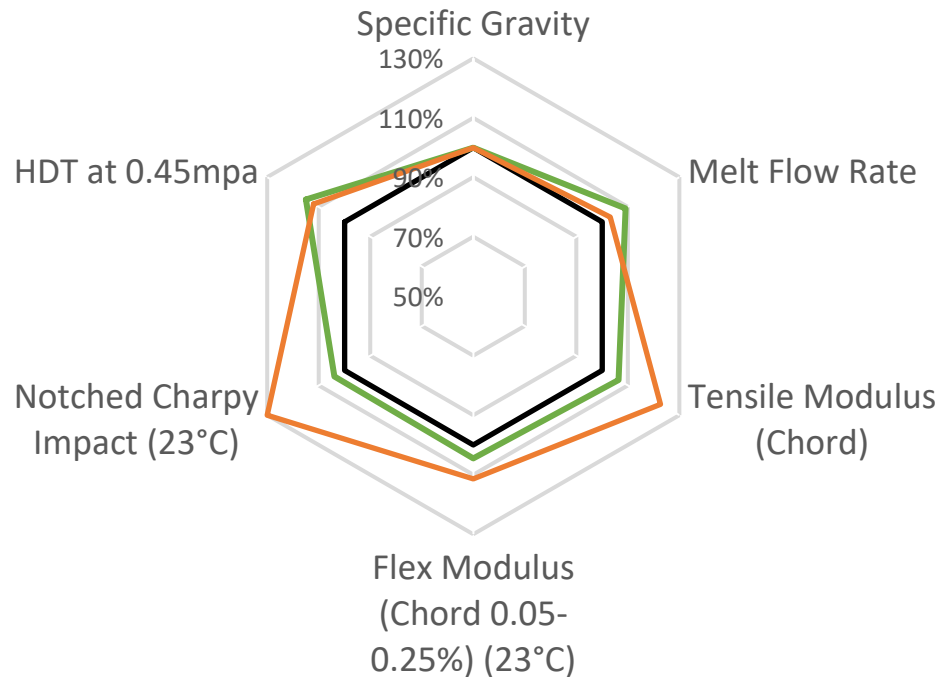
Talc Filled PP		
Product	Description	Recycled Content
ᵀP5120R B2	20% talc filled, homopolymer PP, black, high melt flow	25%
P5120R B24	20% talc filled, homopolymer PP, black	25%
ᵀP5133R B1	33% talc filled homopolymer PP, black	30%
F5134T2-4R	20% talc filled, homopolymer PP, black	25%
F5134T4-1R	40% talc filled, homopolymer PP, black	30%
Glass Filled PP		
Product	Description	Recycled Content
ᵀP5420R B1	20% glass filled homopolymer PP, black	25%
ᵀP5430R B5	30% glass filled homopolymer PP, black	30%
ᵀP5440R B1	40% glass filled homopolymer PP, black	25%
ᵀP6420R B4	20% glass filled copolymer PP, black	10%
Mica Filled PP		
Product	Description	Recycled Content
ᵀP5340R B2	40% mica filled homopolymer PP, black	20%
Glass/Mineral Filled PP		
Product	Description	Recycled Content
ᵀP5930R B1	30% glass/mineral filled homopolymer PP, black	25%
ᵀP5940R B131	40% glass/mineral filled homopolymer PP, black	30%
Misc. Filled PP		
Product	Description	Recycled Content
P6850R B38	50% barium sulfate filled, homopolymer PP, black	25%
ᵀP6225R E49	25% calcium carbonate, homopolymer PP, grey	25%
Product	Description	Recycled Content
ᵀP5000R B1	Homopolymer PP, black	25%



# Natural Fiber Based polyolefin Composites

## GEON Natural Fiber vs Mineral reinforcement

— Customer Spec — GEON Natural Fiber — GEON TP9110 A421-SM



## Portfolio of natural fiber-based polyolefins

- Family of products incorporating natural fibers replacing mineral fillers
- Available options of different bio-contents

## Features

- Lightweight material
- High melt flow for easy processing
- Sustainable material offset to conventional reinforcements
- Customized solutions available (e.g. UV stability, anti-scratching)

Proprietary data.  
Will be shown on the day of the presentation

## RESILIENCE R – **recycled** content in compounds

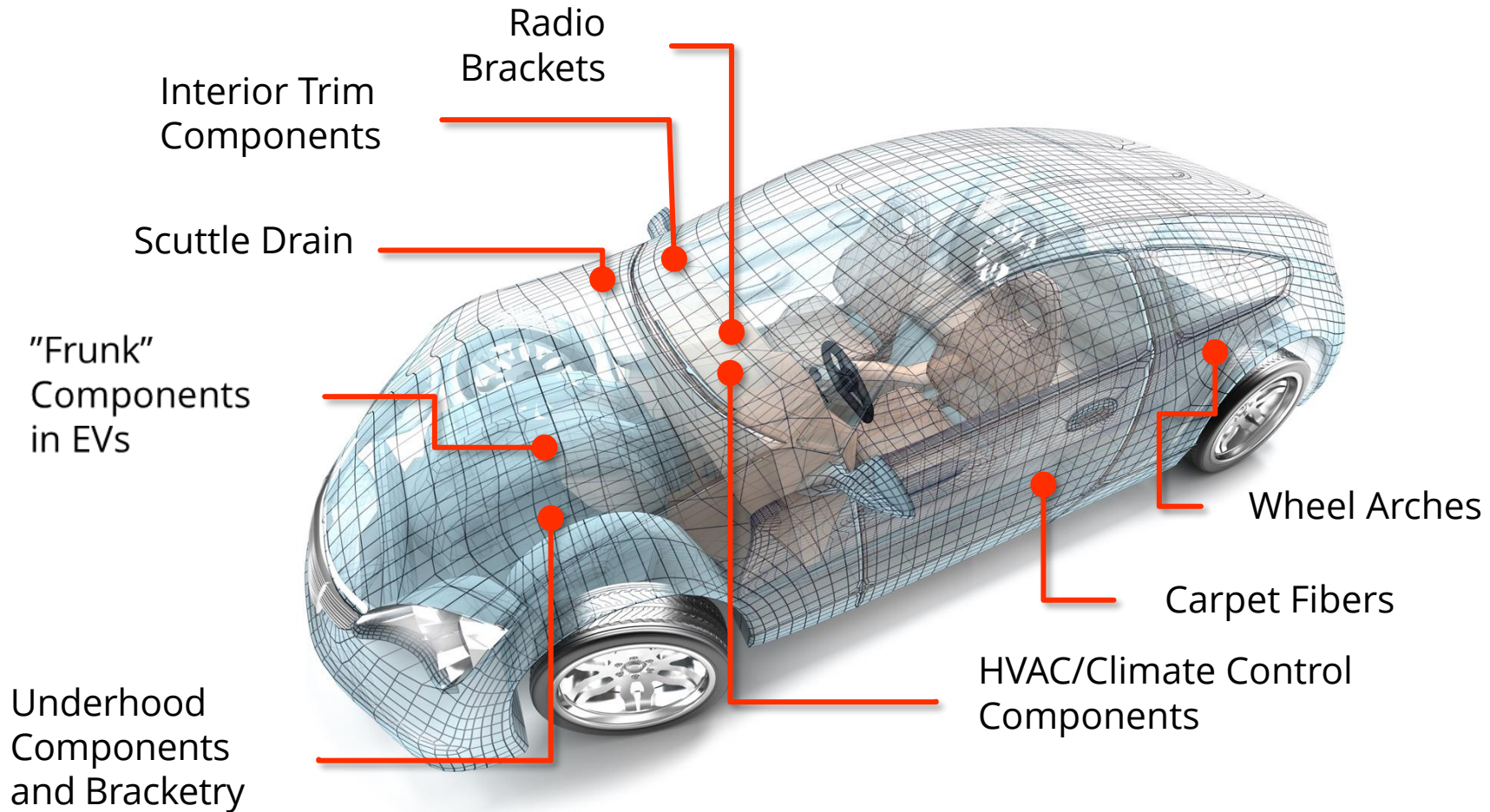
- GEON's broad portfolio of RESILIENCE R grades not only meet the specifications of leading automotive OEMs and other industry manufacturers but show comparable performance to the virgin materials
- Customers have the flexibility to switch back and forth from virgin grades to RESILIENCE R grades as needed, without concerns about changes in properties or processing

## Natural Fibers – **bio-based raw material** incorporation into polyolefin compounds

- Natural fiber in place of mineral filler successfully reinforced the desired properties of polyolefin compounds
- Excellent balance of properties between lightweight, easy flow, high stiffness/HDT and impact was achieved for interior trim applications



# Turning Recycled Plastics into Cars





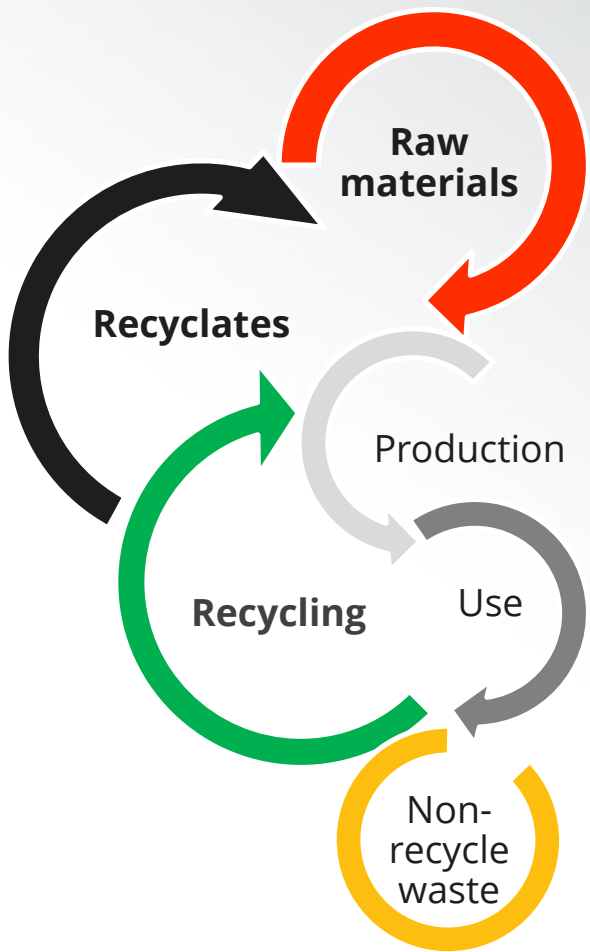
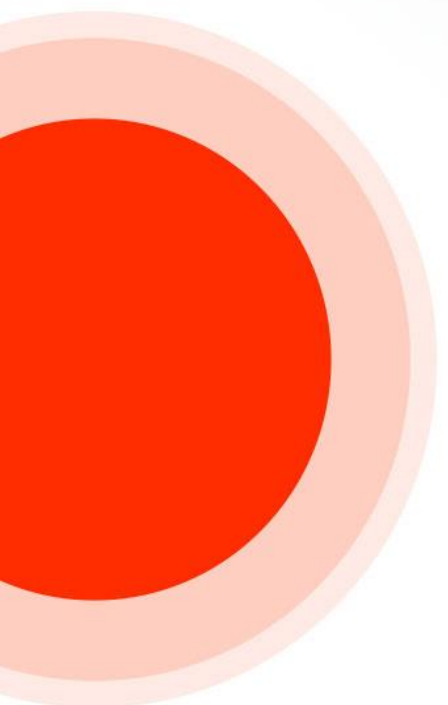


# Thank You!!

For more information, contact **GEON:**

Albert Chan, [albert.chan@geon.com](mailto:albert.chan@geon.com)

Kevin George, [kevin.george@geon.com](mailto:kevin.george@geon.com)

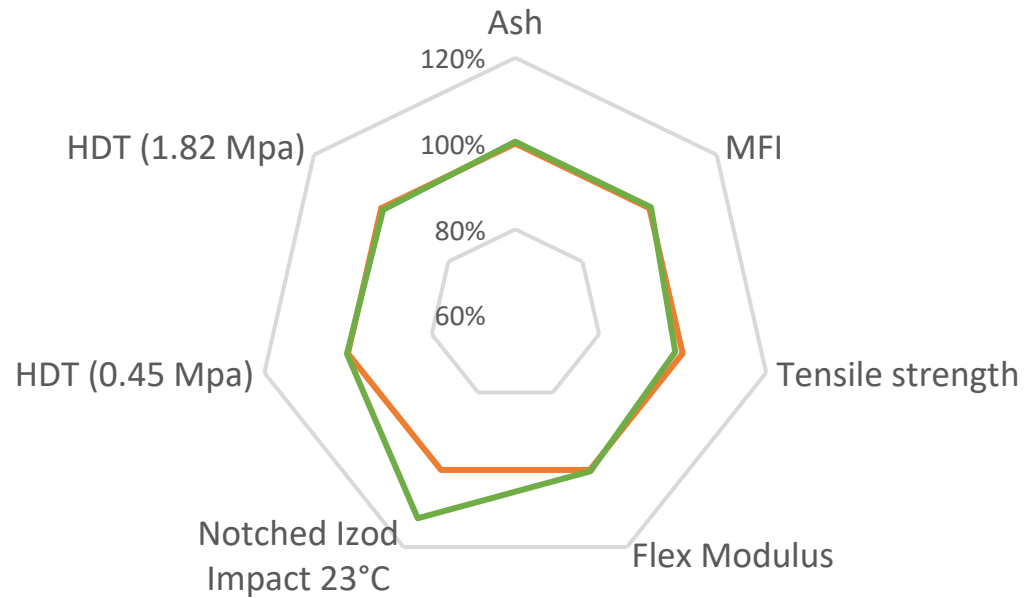


# Appendix

# Comparative Testing – High Flow 20% Talc HPP

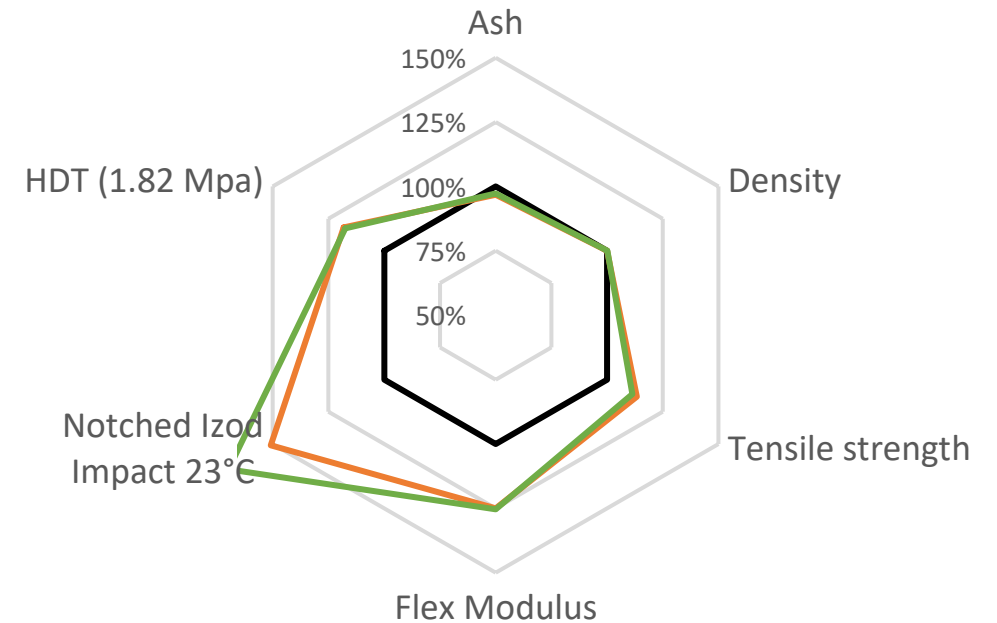
High Flow 20% talc PRIME VS RECYCLED  
Average Property Values

— GEON PP5120F B2 — GEON PP5120R B2 - Recycled



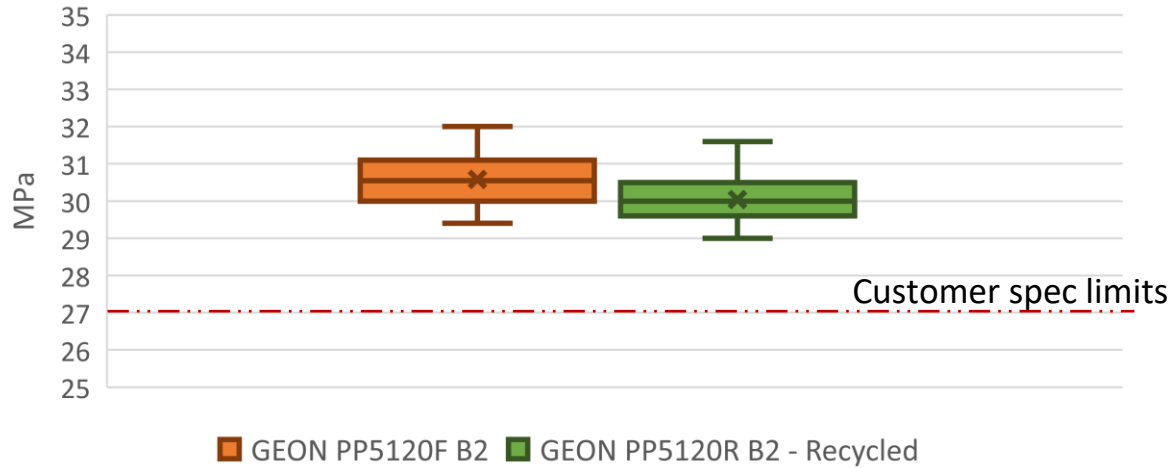
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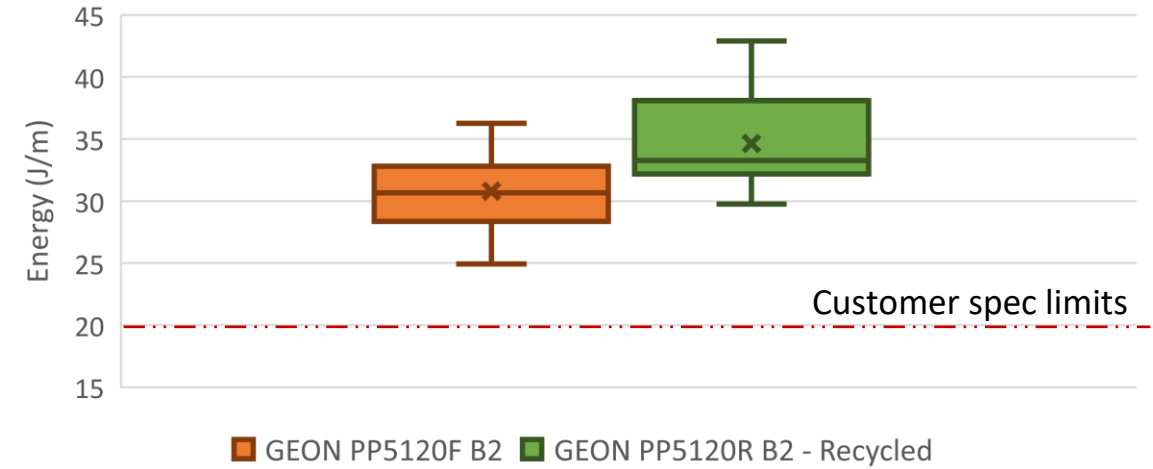


# Comparative Testing - High Flow 20% Talc HPP

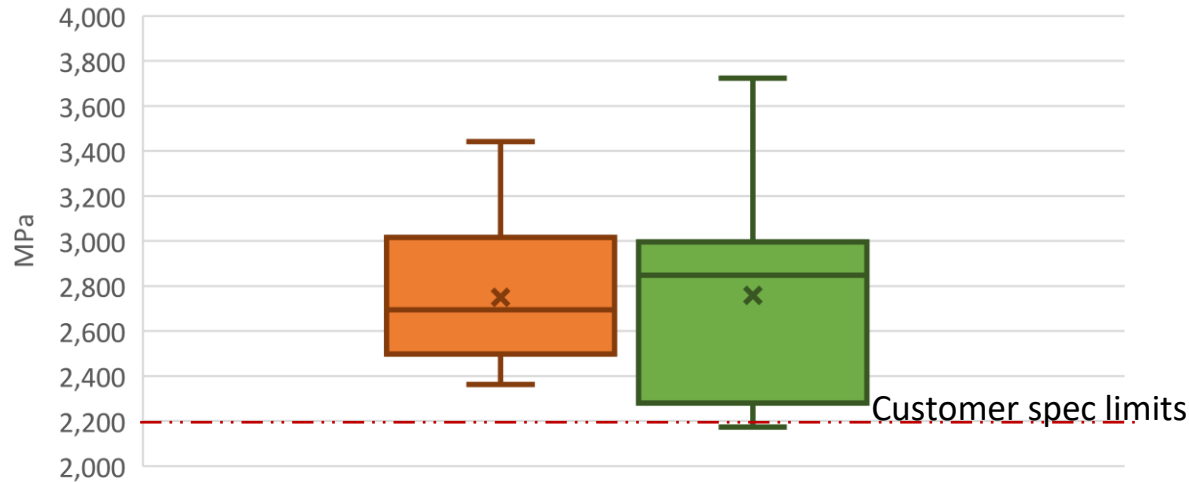
### High Flow 20% Talc HPP - Tensile Strength



### High Flow 20% Talc HPP - Notched Izod Impact



### High Flow 20% Talc HPP - Flex Modulus



### High Flow 20% Talc HPP - HDT (1.82 mpa)

