



**Drive one.**

# Greening the Blue Oval: Sustainable Materials for the Automotive Industry

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# History of Biomaterials at Ford

- 1937 Ford was producing 300,000 gallons of soy oil a year for use in car enamels (*Soybean Digest* 1947).
- 1939 the Ford Motor Company was harvesting about 100,000 bushels of its own soybeans
- The "Soybean Car" was unveiled by Henry Ford on August 13, 1941
- 'Fordite' material used in steering wheels contained wheat straw



From the Collections of The Henry Ford  
Robert Boyer and Henry Ford with the Soybean Car.

*"Someday you and I will see the day when auto bodies will be grown down on the farm."*

– Henry Ford



From the Collections of The Henry Ford  
Image ID#: P.O.15121

Soybean Car assembly image showing production of plastic panels.



# Ford's Commitment

*"Ford is committed to offering customers affordable, **environmentally friendly technologies** in vehicles they really want. We are focused on providing solutions that can be used not for hundreds or thousands of cars, but for millions of cars because that is how Ford can truly make a difference."*



-Alan Mulally  
President & CEO  
Ford Motor Company



# Ford's Sustainable Materials Strategy

- **Vision**

- Ford Motor Company will ensure that our products are engineered to enable sustainable materials leadership without compromise to Product Quality, Durability, Performance or Economics.

- **Key Positions**

- **Recycled** and **renewable** materials must be selected whenever technically and economically feasible. We will encourage the best green technologies to meet the increasing demand for these materials.
- When we use **recycled** and **renewable** materials, there will be no compromise to Product Quality, Durability & Performance or Economics.
- We will enhance technologies, tools and enablers to help validate, select and track the use of these materials in our products.
- The use of **recycled** and **renewable** content is increased year by year, model by model where possible.



# Ford Biomaterials Overview



corn  
 castor beans  
 sugar cane



**Natural Fiber**  
 • thermosets  
 • thermoplastics

**Biobased Resins**

**Soy**  
 • foams  
 • thermoset resin  
 • fillers



hemp  
 switch grass  
 flax

soybeans



# Success of Soy-based Foam

**Applications:** Use of functionalized soy oil in urethane foam for automotive seating and headliner applications

**Status:** Ford is leader in technology and first OEM to launch in production; migration to other non-automotive applications



Soy foam headliner



Soy foam seats

- Soy foam seats on all vehicle platforms in North America!!
- Over 3 million Ford vehicles on the road today have soy foam seats
- Escape has soy foam headliner
- 75% headrests contain soy foam
- Reduces petroleum usage by 3 million lbs annually & CO2 by 20 million lbs



# Driving Green Solutions For **All** FMC Vehicles



# OARDC - Ford

- Partnering with OSU – OARDC to develop Russian Dandelion and Guayule (GY) as a domestic source for natural rubber
- Potential use as a rubber modifier in TPO or bio-based plastic materials for interior trim applications



# Project Overview

- Use GY as an impact modifier in both PP and PLA
  - PP Formulations
    - 5, 10 and 20% loading of GY
  - PLA Formulations
    - 10% GY, 25% PLA, 65% PP
    - 10% GY, 65% PLA, 25% PP
    - 10% GY, 90% PLA
- Compare (PP based) to traditional automotive TPOs



# Sample Preparation

- Use cryogrinder to prepare GY
  - Gummy, sticky
  - Spex 6800 freezer mill
    - Electromagnets
    - Liquid nitrogen
  - Grind 50/50, PP & GY



# Processing Slide

- Extrusion/Compounding
  - Davis-Standard extruder
    - Guayule filled PP
      - 5,10 and 20% loading
  - Water bath, pelletizing
  - Temperatures: 365F-410F
  
- Injection Molding
  - BOY 80 Ton
    - ASTM mold: flexural and tensile bars
    - Temperatures: 395F-420F
    - Mold temp: 75F
    - Injection pressure: 800/1300 psi



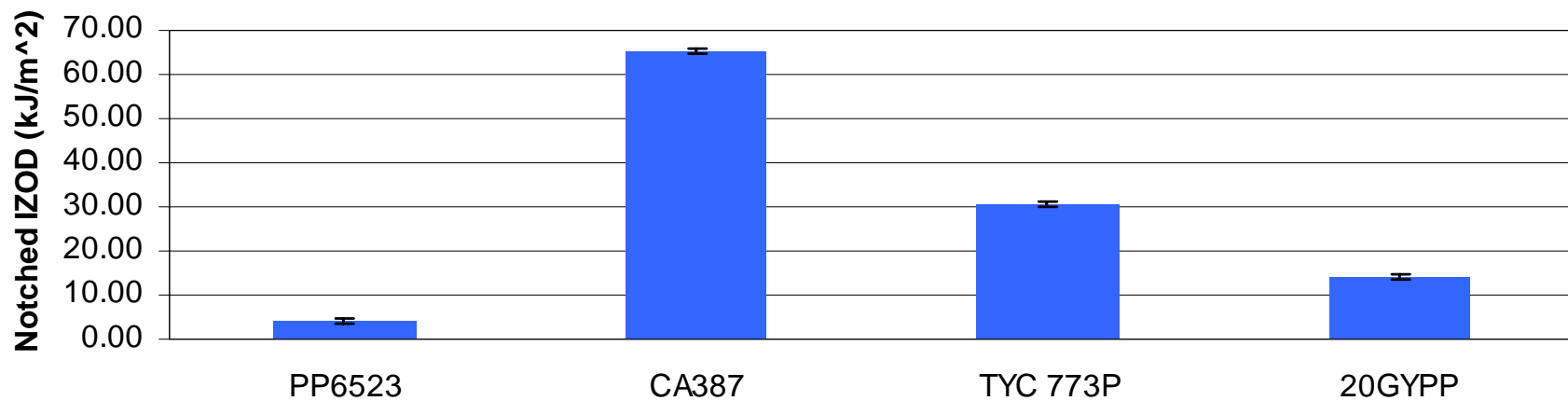
# Testing Methods

- Mechanical Properties
  - Flexural (ASTM D790)
  - Tensile (ASTM D638)
  - Notched IZOD Impact (ASTM D256, method A)



# Impact results: PP based

## Notched IZOD



Sample Name	Sample Description	Notched Izod (kJ/m <sup>2</sup> )	Std Dev	Type of Break
PP6523	PP Natural	4.05	0.60	CB
CA387	CA387 Reactor grade TPO	65.20	2.92	Hinge
TYC 773P	TYC 773P TEO	30.70	1.56	Hinge
20GYPP	PP 80% Guayule 20%	13.93	2.6	Hinge



# Next Steps

- Increase loading of GY to 30% in PP
- Dynatup Testing
  - 5 mph impact test
- Evaluate dandelion rubber as a modifier
- Modify PP with GY and natural fiber
- Track scale-up, perform larger trials



Thank you!

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Questions?



Research & Advanced Engineering