DuPont Cerenol™

A New Family of High Performance Bio-Based Polymers

Presented to:	Sarnia Bio-Based Polyols
Presented by:	Hari Sunkara & Howard Ng
Date:	October 19, 2006

DUPONT®
The miracles of science™

Agenda

- DuPont's Renewable Sourced Materials for sustainable growth

- Cerenol™ - A new family of high performance bio based polyols

- We would like to learn about your needs and find opportunities to work together in creating bio based solutions to your customers

Bio Based Materials group is founded on one of DuPont's core strategic growth initiatives:

- To reduce our environmental footprint

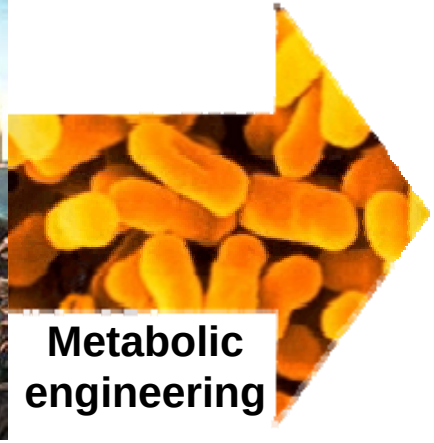
	2010 Goals	2004 Data vs 1990
Greenhouse gas emissions	< 65%	**<72%**
Revenue from non-depletable raw materials	25%	17%
Energy consumption	Flat	**94%**
Energy from renewable sources	10%	5%

*Incl. Invista

Cerenol™ is part of the first generation of DuPont's bio-based innovation

The right science at the right time

Biomass feedstock

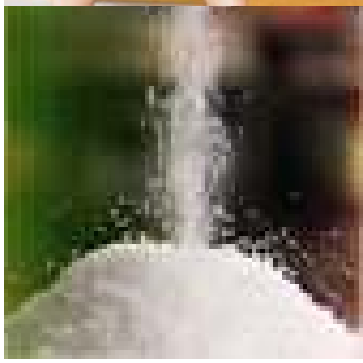


Metabolic engineering

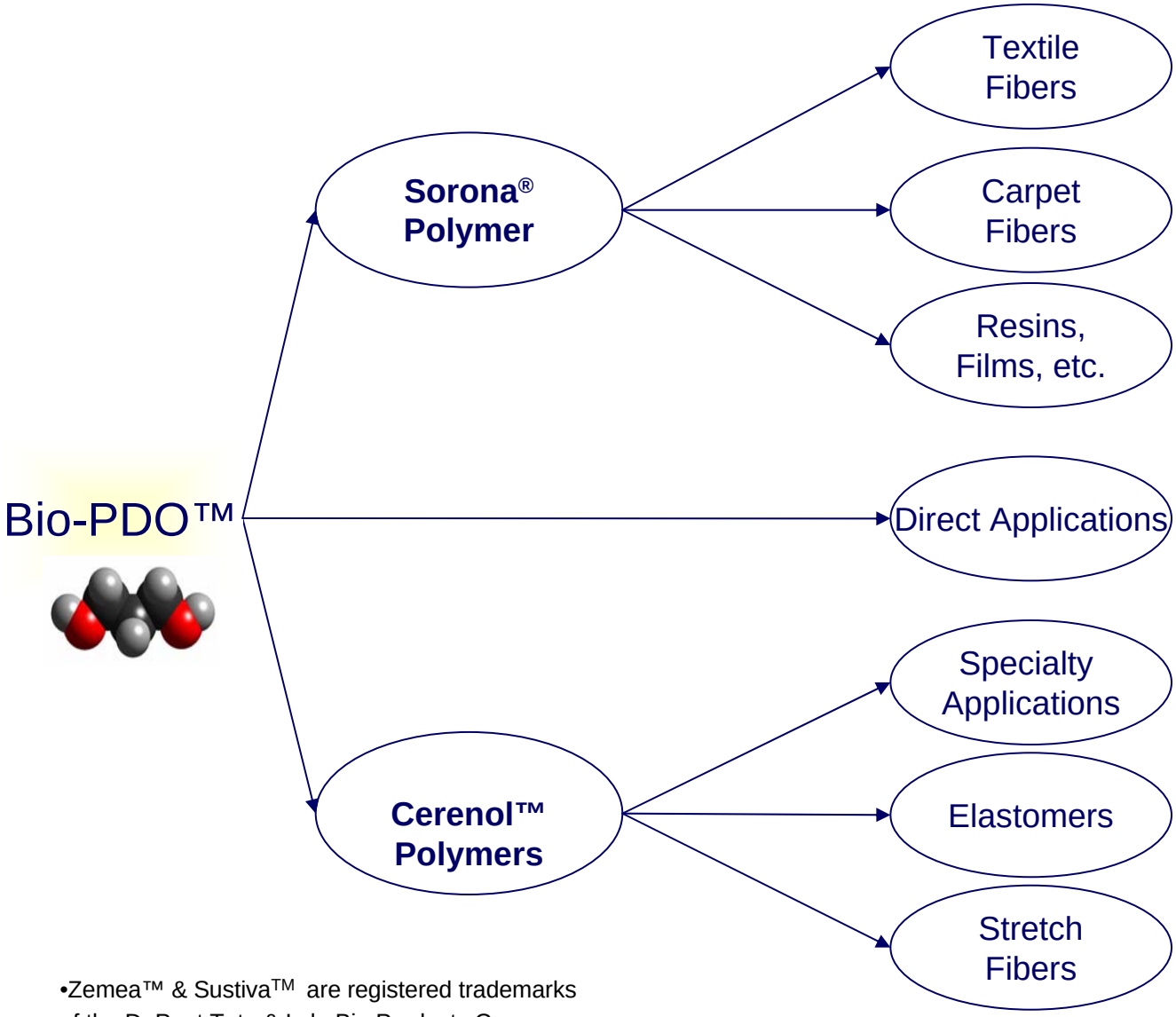
Energy: bio-fuels

Materials:
- DuPont Sorona®
- DuPont Cerenol™

Chemicals
- Ethanol
- Bio-Butanol
- Bio-PDO™



Bio-PDO™ serves as a building block for diverse applications and markets



- Sorona®

Zemea™ & Sustiva™ Propanediols*

- Cerenol™

•Zemea™ & Sustiva™ are registered trademarks of the DuPont Tate & Lyle Bio Products Company

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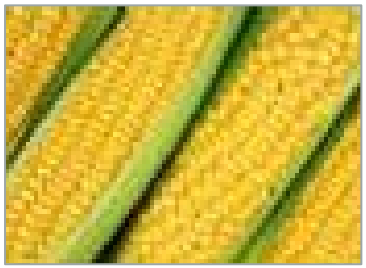
- DuPont’s Renewable Sourced Materials for sustainable growth

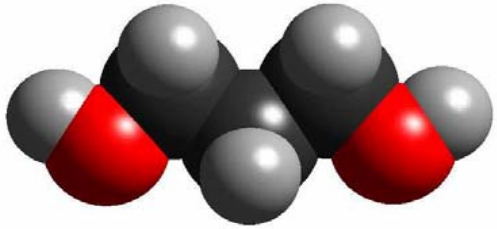
- Cerenol™ - A new family of high performance bio based polyols

- We would like to learn about your needs and find opportunities to work together in creating bio based solutions to your customers

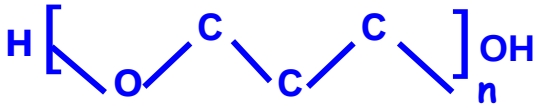
Cerenol™ is DuPont's registered brand name for a new family of Bio Based Polyols from renewable materials



Biomass Feed Stock



Bio-PDO™



Cerenol™

Cerenol™ Polyols Overview

- DuPont is committed to Cerenol™ polyols and Cerenol™ - based polymers
- There are a broad range of applications and markets for Cerenol™ polyols
- DuPont Cerenol™ has patents on compositions, processes and end uses
- Cerenol™ has a unique chemistry that results in value added properties
- Cerenol™ products and manufacturing process are inherently environmentally friendly
- A number of Cerenol™ products are in commercial development and will be available soon.

DuPont is committed to Cerenol™: Investing to to ensure PDO supply

DuPont Tate & Lyle Bio-PDO Investment: Loudon Plant - 3/17/06

DuPont is committed to Cerenol™: Leveraging on existing businesses

- New DuPont Car Finishes Will Be Tougher Due to Polymers Made With Renewable Resources
  - WILMINGTON, Del., June 19, 2006 – A new generation of tough, chip-resistant DuPont automotive refinish products, reinforced with newly invented bio-based polymers, could be available for use in auto collision repair centers by 2008. The new coatings will be made using renewably sourced intermediate ingredients that are biodegradable and virtually non-toxic.
- DuPont To Produce New High-Performance Polymers Made with Renewable Resources.
  - WILMINGTON, Del. June 27, 2006 – DuPont expects to begin production in 2007 of new high-performance thermoplastic resins and elastomer products made from two of its latest bio-based materials innovations. The products will be targeted for automotive, electrical/electronic and other industrial markets.

Broad range of applications and markets

Automotive Refinishing

Inkjet Inks

Personal Care

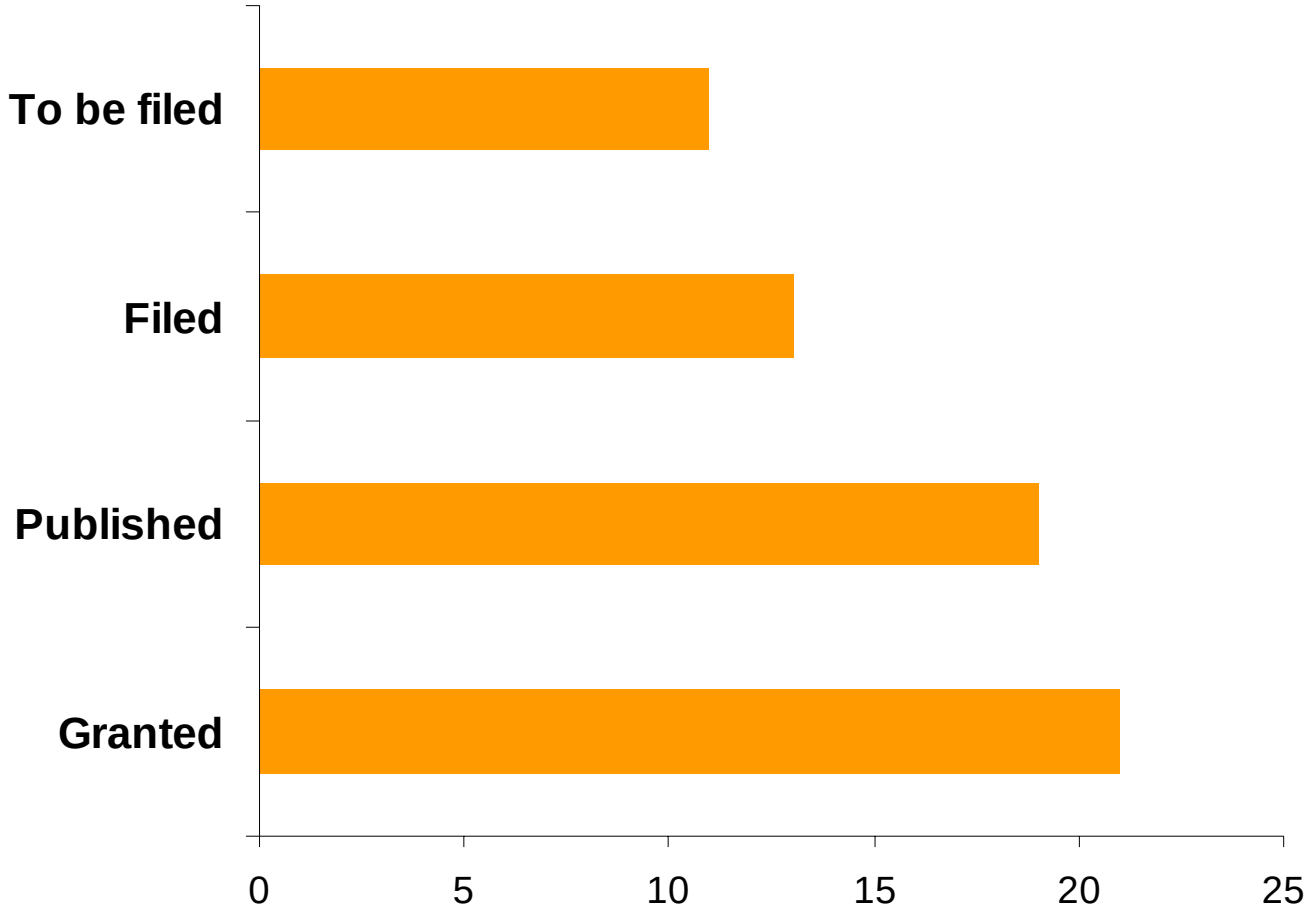
Lube and Greases

Elastic fibers

A variety of articles for automotive and sporting end uses

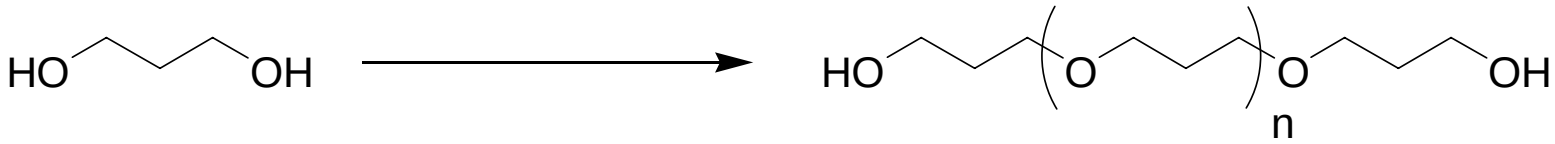
DuPont Cerenol™ has a strong patent position on compositions, processes and end uses

More than 60 US Patent Applications since 2000



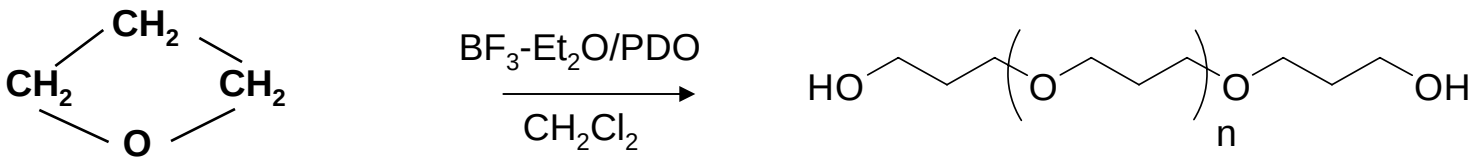
Cerenol™ has a unique chemistry that results in value added properties

Polycondensation



1,3-Propanediol **Polytrimethylene ether glycol**

Ring opening polymerization



Oxetane **Polytrimethylene ether glycol**

Cerenol™ has a unique chemistry that results in value added properties (cont.)

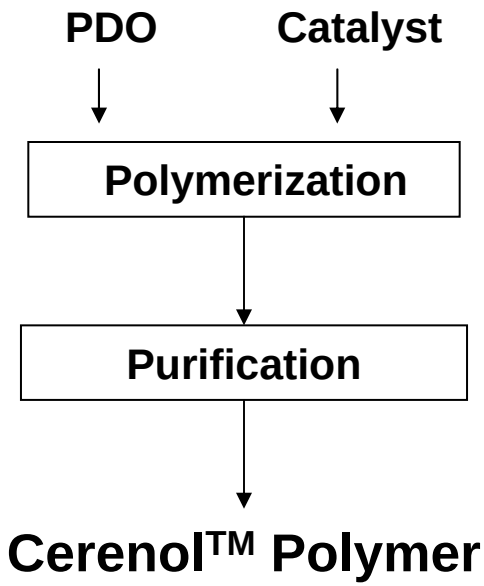
Value Added Properties

- Liquids with low or no melting
- Hygroscopic / hydrophilic/ lipophilic
- Amorphous / semicrystalline
- Low volatile, ionic/non-ionic, neutral
- Water soluble/insoluble
- Low toxicity & Bio-degradable
- Hydrolysis resistant
- Easier to handle and process

Cerenol™ products and manufacturing process are inherently environmentally friendly

Very safe to manufacture

- Batch Process
  - Polymerization & Purification methods
  - US 6,977,291 (2005)
  - US 7,074,969 (2006)
- Continuous Process
  - Pilot scale demo in 2000
  - US 6,720,459 (2004)
  - US 7,074,968 (2006)
- Grades : 500-3000 MW



Cerenol™ products and manufacturing process are inherently environmentally friendly (cont.)

Conventional polyol ingredients versus Cerenol™ ingredient

- Renewable source
- Low volatility
- Non-flammable
- High flash point
- Less reactive
- Low toxicity
- High oxidative stability
- Easier to handle, process and transport

Cerenol™ products and manufacturing process are inherently environmentally friendly (cont.)

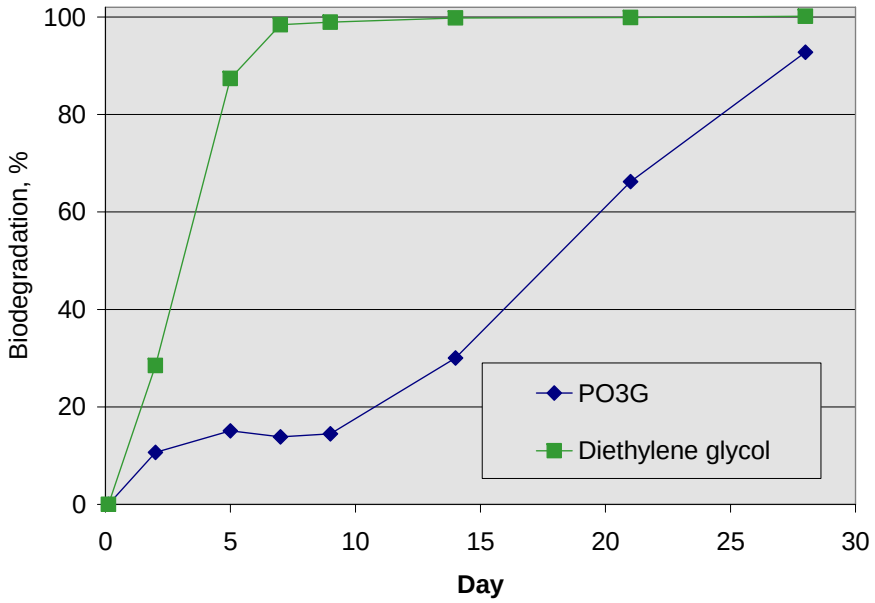
Product Low Toxicity

- Polymer grade Cerenol™ has been tested
  - Not a skin and eye irritant
  - Not a skin sensitizer
  - Has low acute oral mammalian toxicity (LD50 > 2000 mg/kg)
- Human patch test results indicate specialty grade Cerenol™ is not
  - a primary skin irritant
  - a fatiguing agent and
  - a sensitizing agent

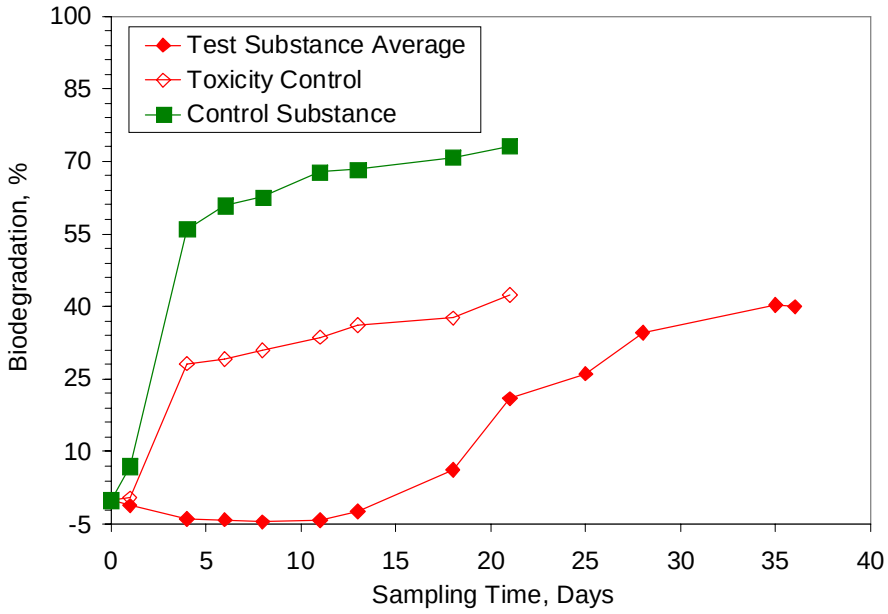
Cerenol™ products and manufacturing process are inherently environmentally friendly (cont.)

Biodegradability

Inherent Biodegradability



Ready Biodegradability



35% degradation in 28 days and **45%** degradation in 35 days

A number of Cerenol™ products are in commercial development and will be available soon.

1. Polytrimethylene ether glycol homopolymers

2. Polytrimethylene ether glycol copolymers

3. Thermoplastic Elastomers (TPE)

1 Polytrimethylene ether glycol - homopolymers

- A Linear Polyether glycol with Odd number of Carbons
- Unusually Compact Chains
- Highly flexible molecules
- Semicrystalline polymer with slower crystallization rates
- Low melting points
- Reactive hydroxyl end groups
- Excellent thermo-oxidative stability
- Very low toxicity
- Biodegradable
- Ideal soft segment for block copolymers

Typical Specs of Cerenol™ Polyols

Property	Cerenol™
Molecular weight	500 - 3000
Hydroxyl number	224 - 37
Alkalinity, meq/30kg	-2.0 to 1.0
Unsaturation, meq/g	< 0.02
Color, APHA	70 max
Melting Point, °C	10 – 22
Density, g/cc (40°C)	1.02 – 1.03
Viscosity, cP (40°C)	100 – 1500

❷ Polytrimethylene ether glycol copolymers

- Poly(trimethylene-co-ethylene ether) glycol
  - (US Patent Publication 2005/0176921)

- Poly(trimethylene ether ester) glycols
  - (US Patent Nos: 6,316,586; 6,608,168)

Copolyols alter the properties of homopolymers

- water insoluble to water soluble
- crystalline to amorphous
- enhance low temperature properties

Bio Based Lubricants with excellent lube properties (US Patent Publication 2005/0014661)

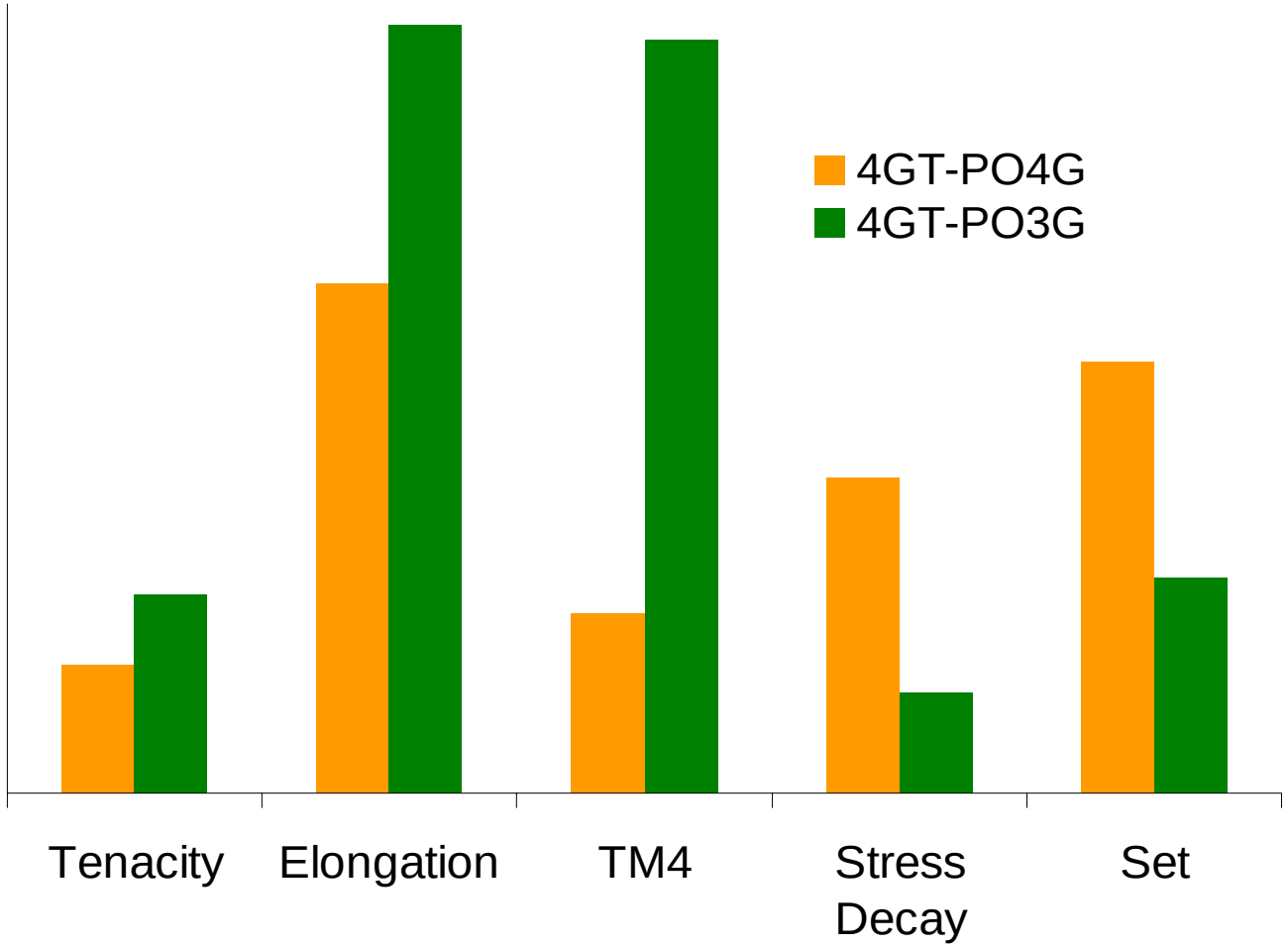
- High viscosity index
- Low pour points
- High flash and fire points
- Excellent low temperature properties
- High load index
- Low coefficient of friction
- High Load carrying capacity
- Very good thermo-oxidative stability
- Water soluble/insoluble

❸ Thermoplastic Elastomers (TPE)

1. **Polyetherester Molding Resins**
   - PBT/Cerenol™
   - PTT(Sorona®)/Cerenol™
   - Hytrels® with renewable materials
2. **Polyetherester Block-amide Molding Resins**
   - Thermoplastic molded and formed products
3. **Polyurethane/urethane-urea (TPU)**
   - Includes cast elastomers, spandex fiber

High Performance Cerenol™ Based Polyether-esters (US Patents 6,599,625; 6,562,457; 2005/0282966)

Flexible Films



Cerenol™ Based Polyetherester Amides

(US Patent No: 6,590,065)

Properties

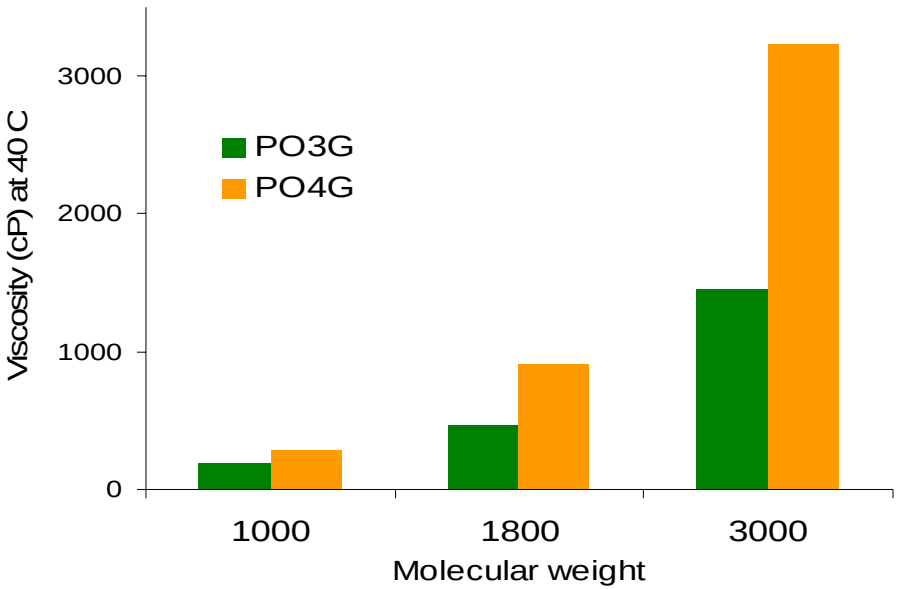
NB#	Wt. % HS	Hard Segment	Soft Segment	Tenacity	Eb (%)	UP 300/200	% Set 300
Pebax® 3533	25	N12	**PO4G**	1.75	202	~0	>>113
E97700-119	25	N12	**PO3G**	1.02	460	108	38

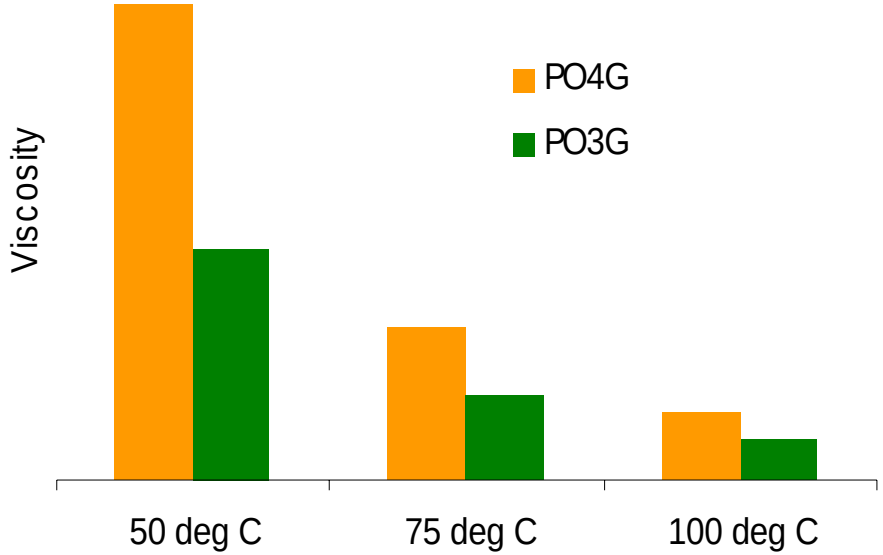
Pebax® is a registered trademark of Arkema, Inc.

Performance Comparisons of Polyurethane / Ureas (US Patent No's: 6,852,823; 6,946,539)

Viscosity of Polyols and Polyurethane Prepolymers:

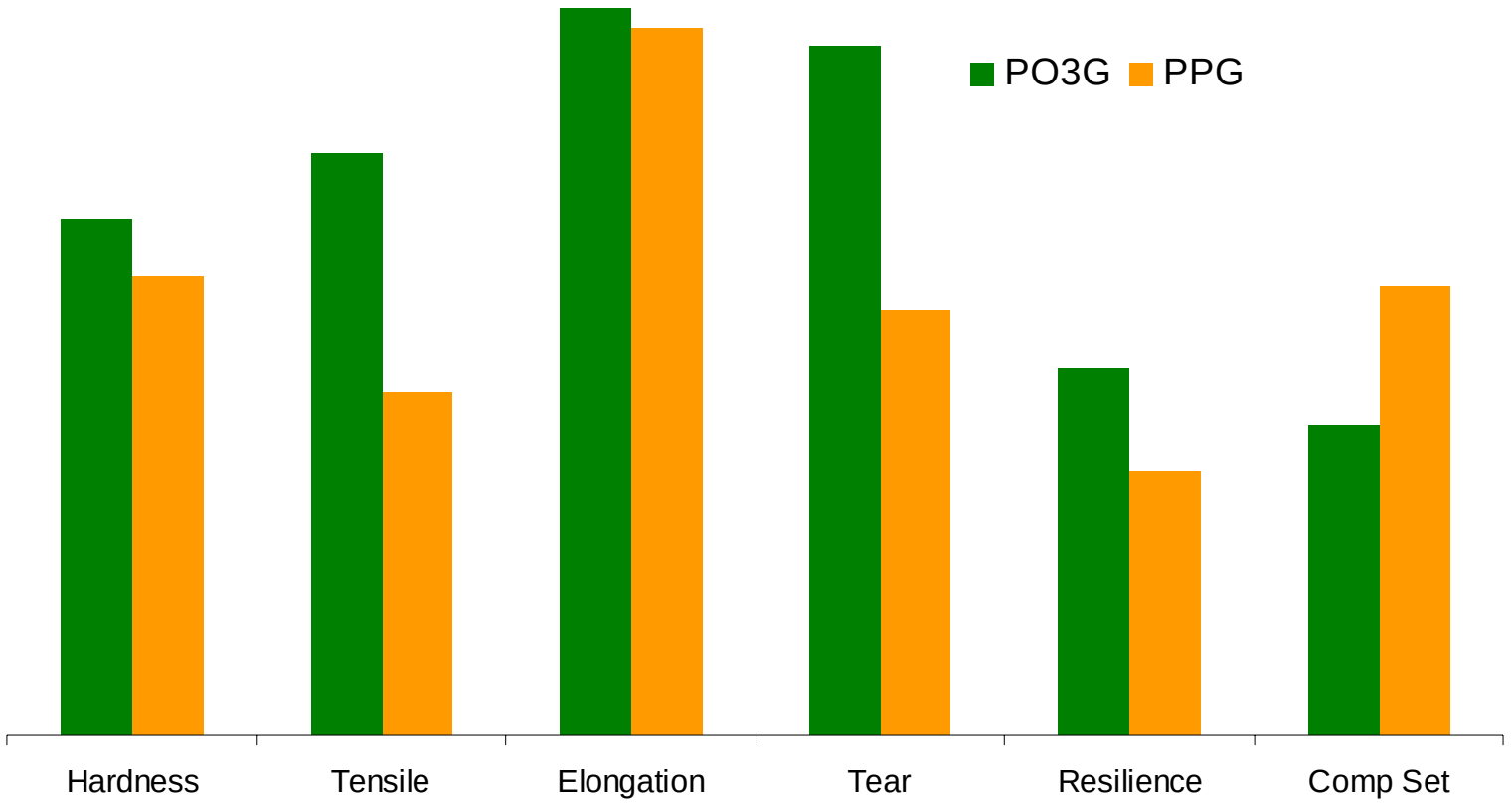
- Ease of handling and processability





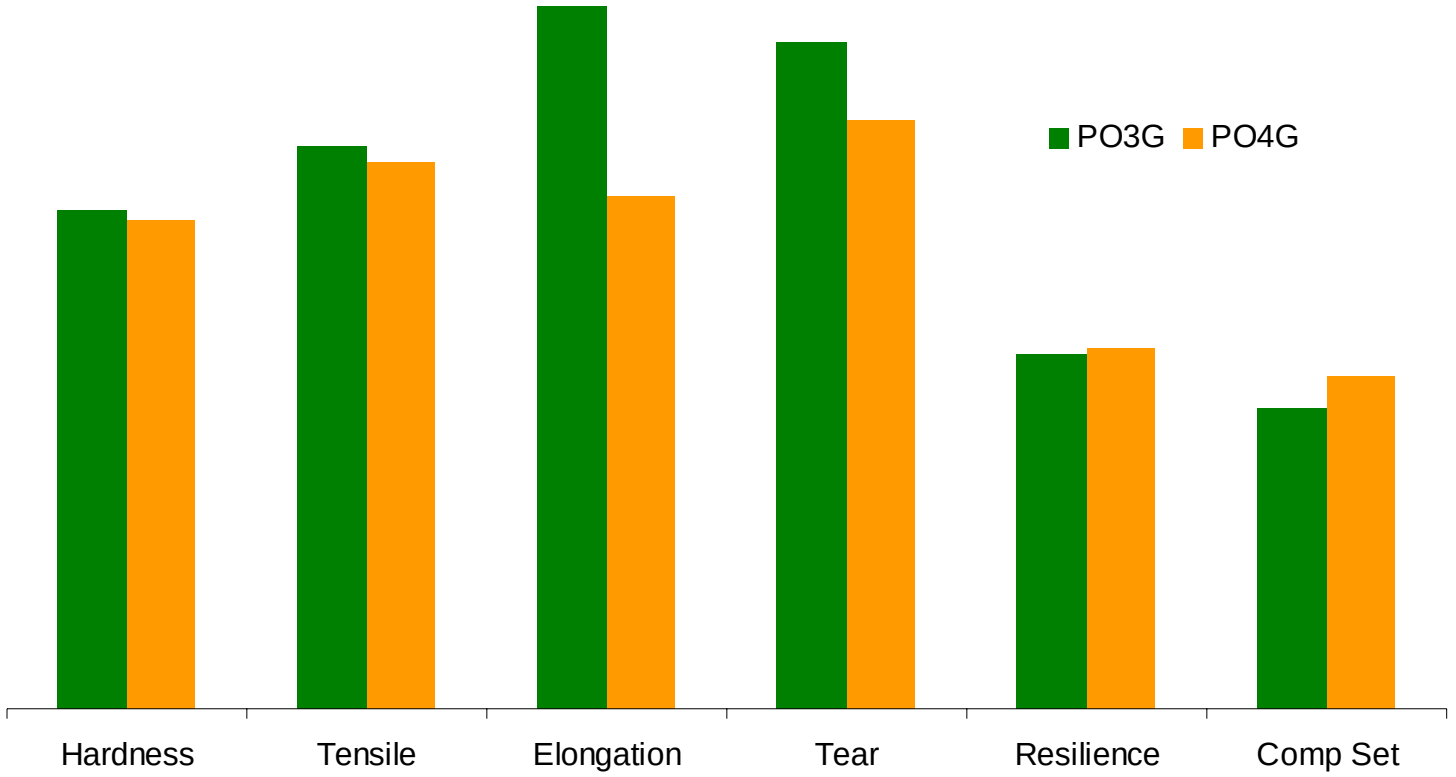
Performance of Cerenol™- based and conventional polyurethanes

Superior performance yet as flexible as PPG-urethanes



Performance of Cerenol™- based and specialty polyurethanes

Cerenol™ Based Urethane is highly elastic and tougher



Cerenol™ based coating formulations

(US Patent 6,875,514)

Excellent chip resistance performance without sacrificing other properties

Control formulation →

← **Bio-based formulation**

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➡ We would like to learn about your needs and find opportunities to work together in creating bio based solutions to your customers

We would like to learn about your needs and find opportunities to work together

- Selective grades of Cerenol™ will be available very soon to our internal business units and potential external partners

- We would like to learn about your bio based polyol and polymer needs

- We would like to explore new opportunities by working together

DuPont Cerenol™ contacts

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  - (302-999-4924)

- Hector Sandoval
  - Global Product Manager
  - (302-999-3075)


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