IISRP's 48th Annual General Meeting
Hyatt Regency, New Delhi

THE ROLE OF TPEs IN THE FLEXIBLE POLYMER INDUSTRY

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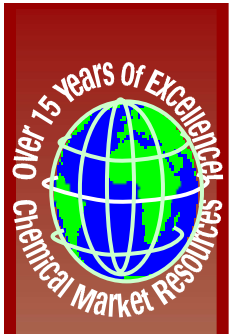
Presentation Outline

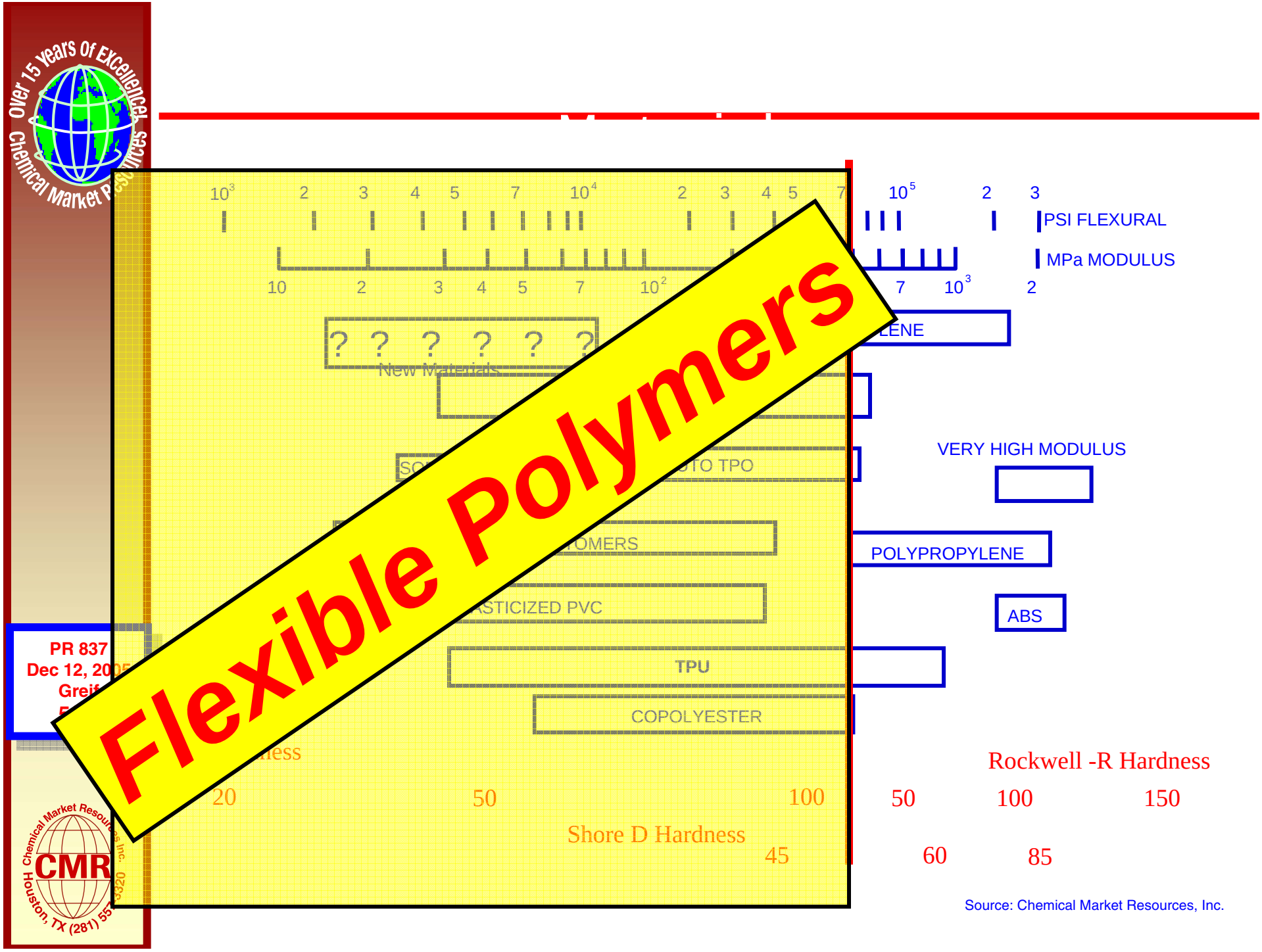
- Introduction
- Flexible Polymers – Definitions
- Flexible Polymers – Families – End Uses
- Role of TPEs in Flexible Polymers
- Future Direction
- Conclusions & Remarks

Flexible Polymer Industry – Current Situation

- **External Factors**
  - General Slowdown in Advanced Countries
  - Growth in China, India and the South East Asia
  - Commodity polymers moving to Middle East
  - Global Product Migration Trends
- **Internal Factors**
  - Lower Utilization
  - Feed stock Cost Positioning
  - New Innovations on Hold



Flexible Polymers Definition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Flexible Polymers
New Materials
TPU
COPOLYESTER
PSI FLEXURAL
MPa MODULUS
VERY HIGH MODULUS
POLYPROPYLENE
ABS
Rockwell -R Hardness
Shore D Hardness
20
50
100
45
60
85
150
Source: Chemical Market Resources, Inc.
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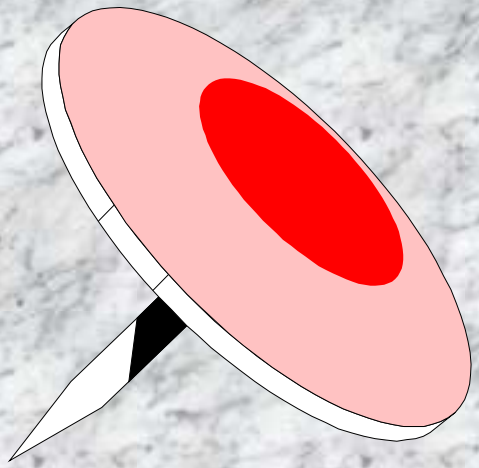
The Growth Driver Trees



Flexible Polymers Tracking System

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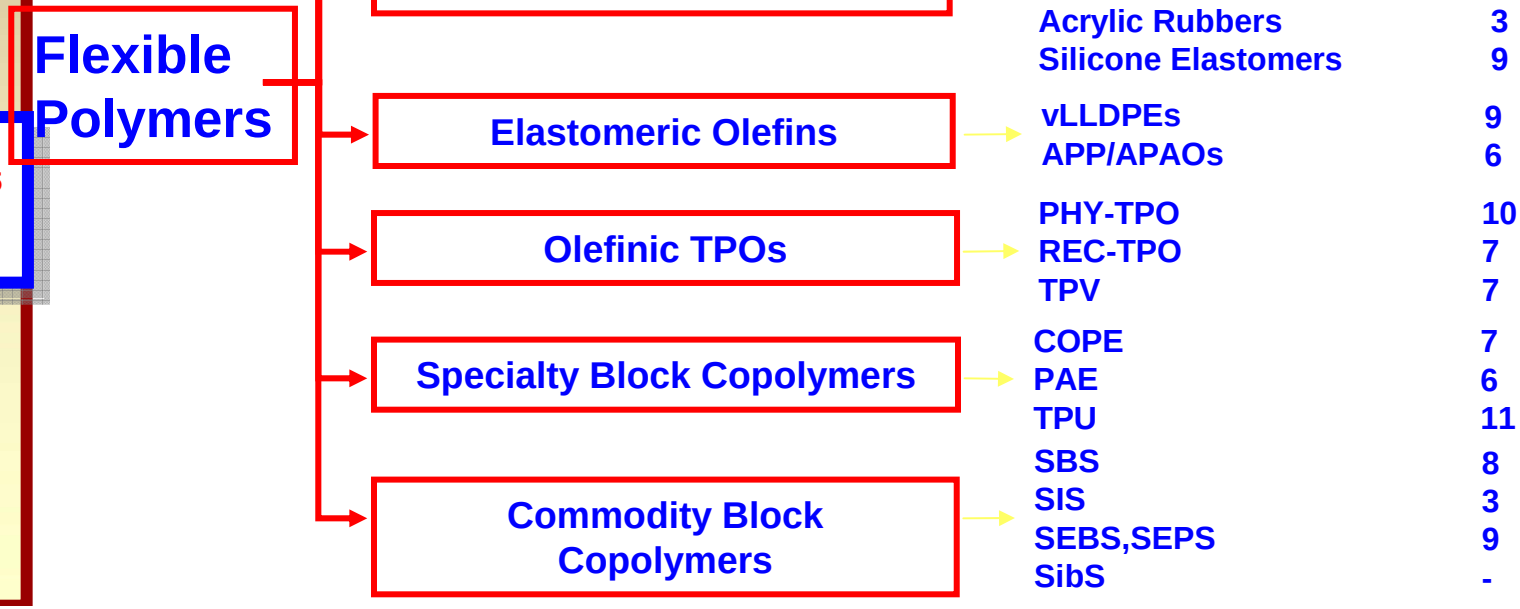
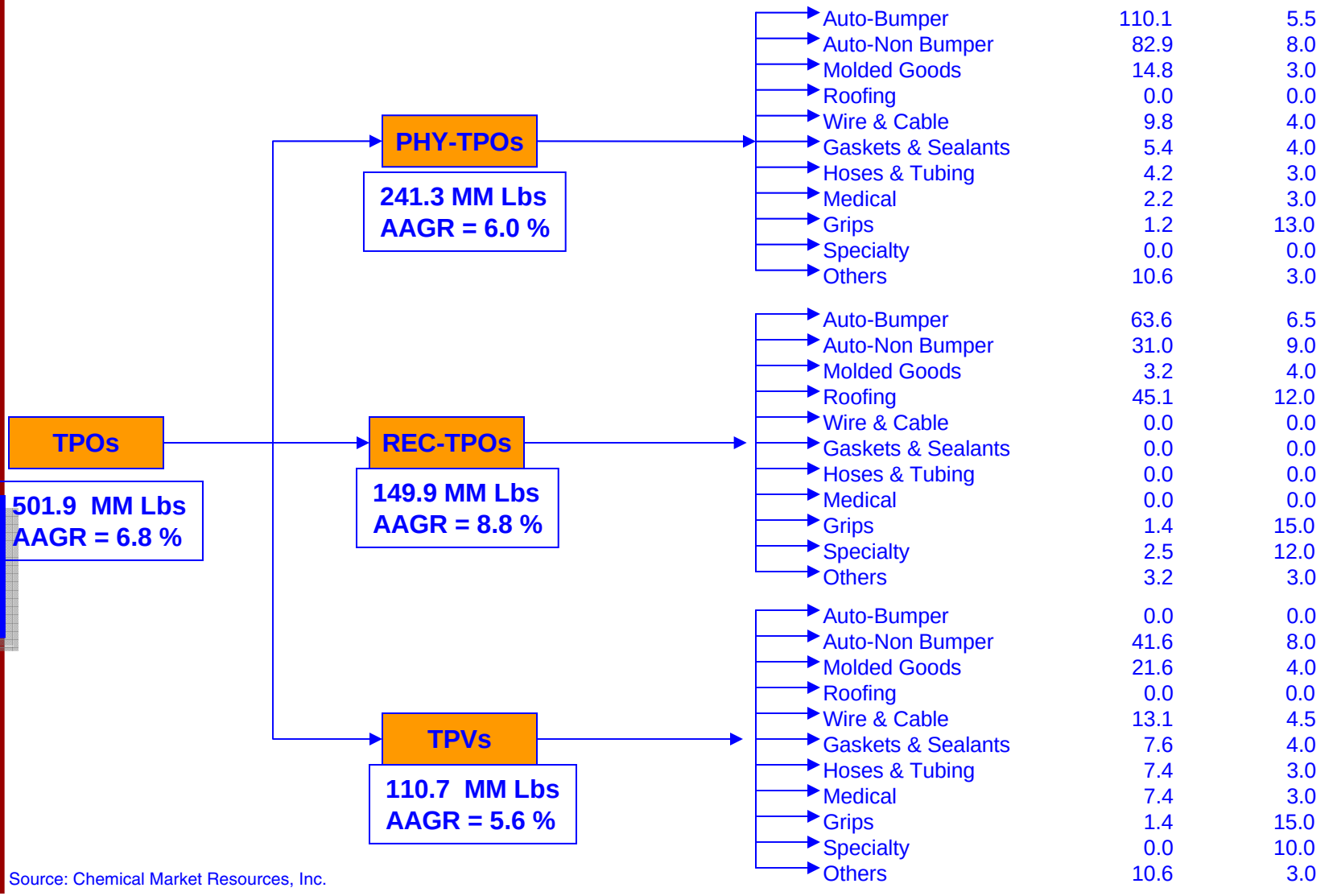
Flexible Polymer Classification



Growth Driver Tree Analysis, North America, 2001



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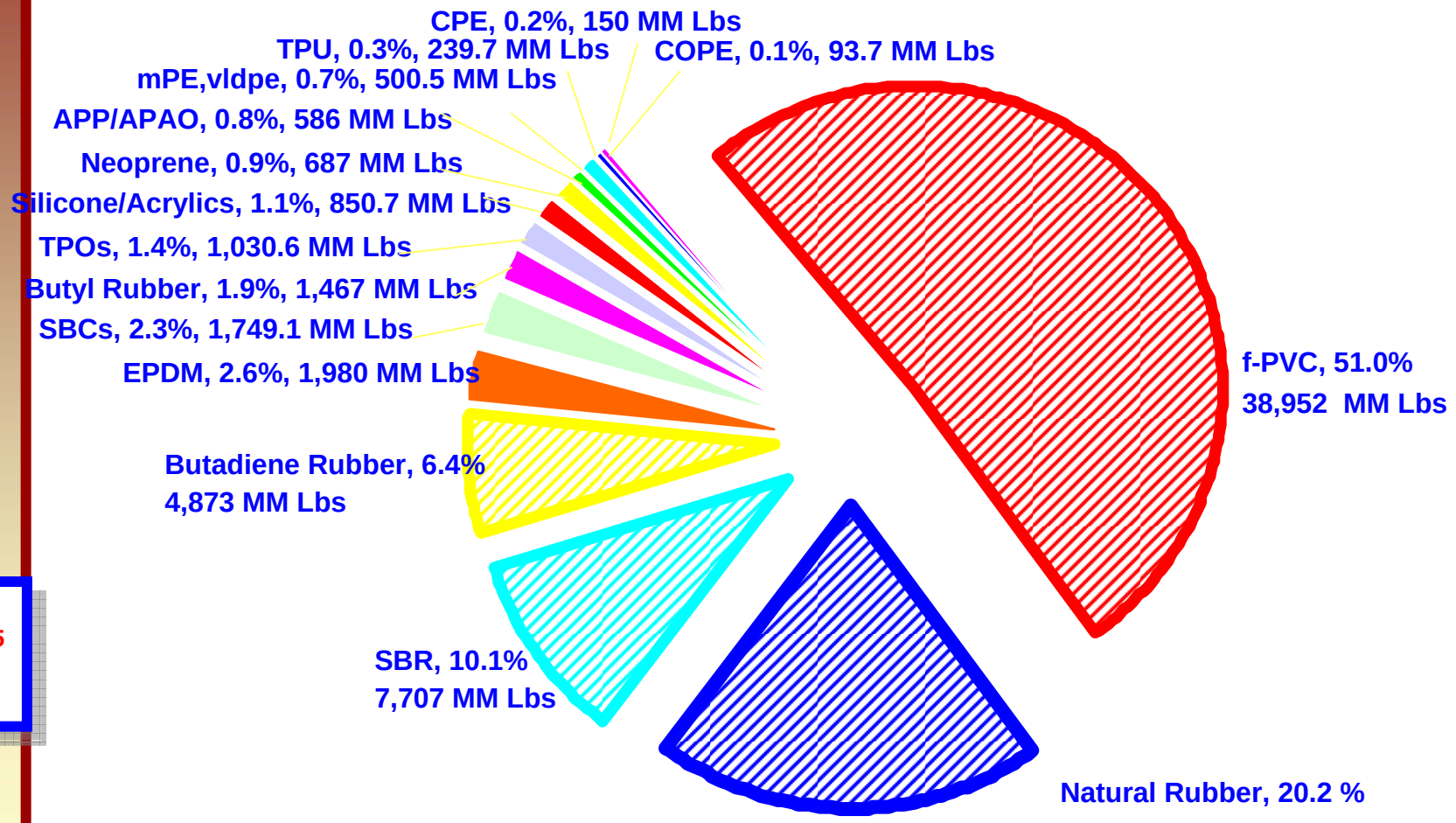
Global Demand for Flexible Materials, 2001



Total Demand of Flexible Polymers, 2001 = 76 Billion Lbs

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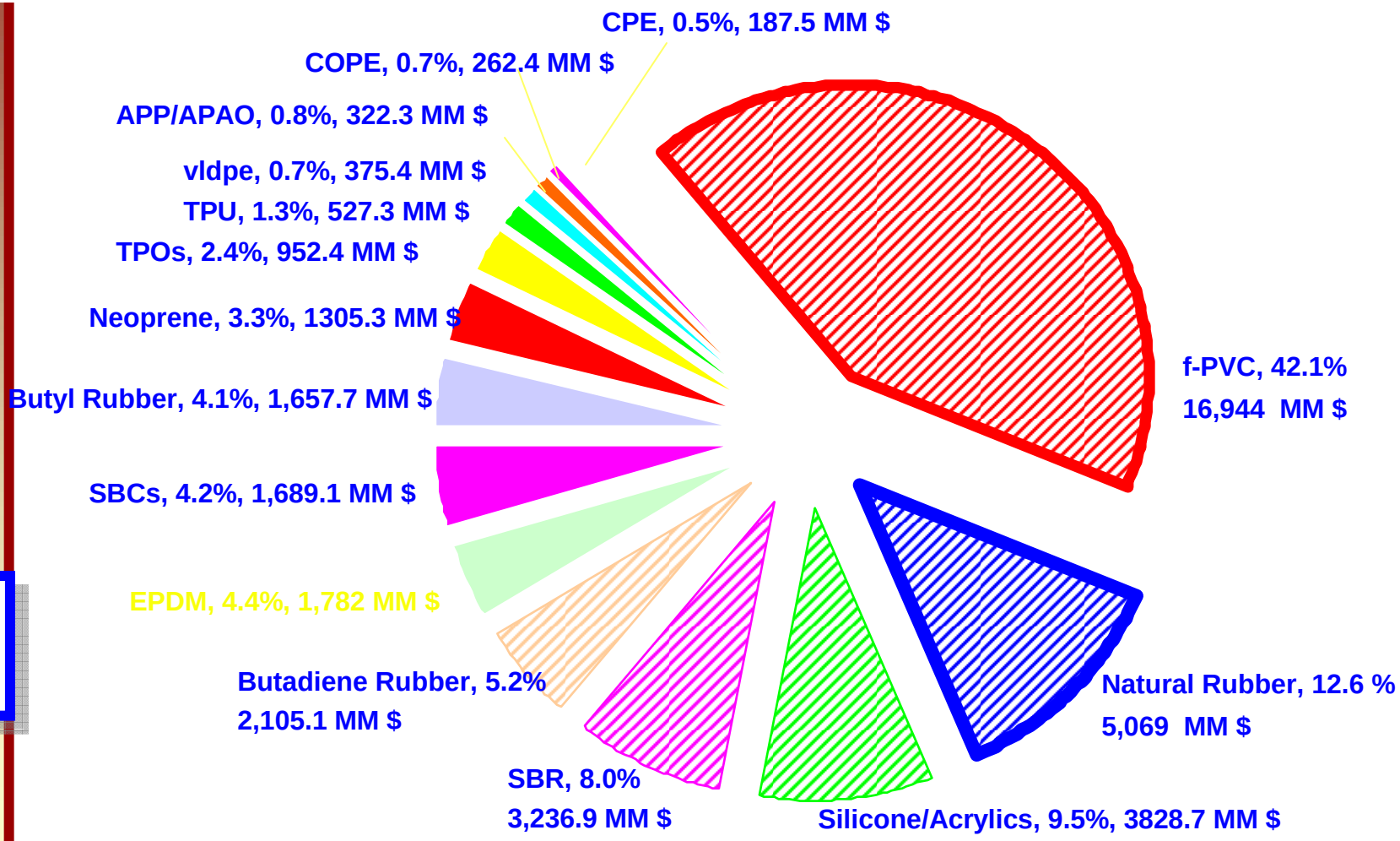
Global Demand for Flexible Materials, 2001



Total Value of flexible materials, 2001 = 40.2 Bn$

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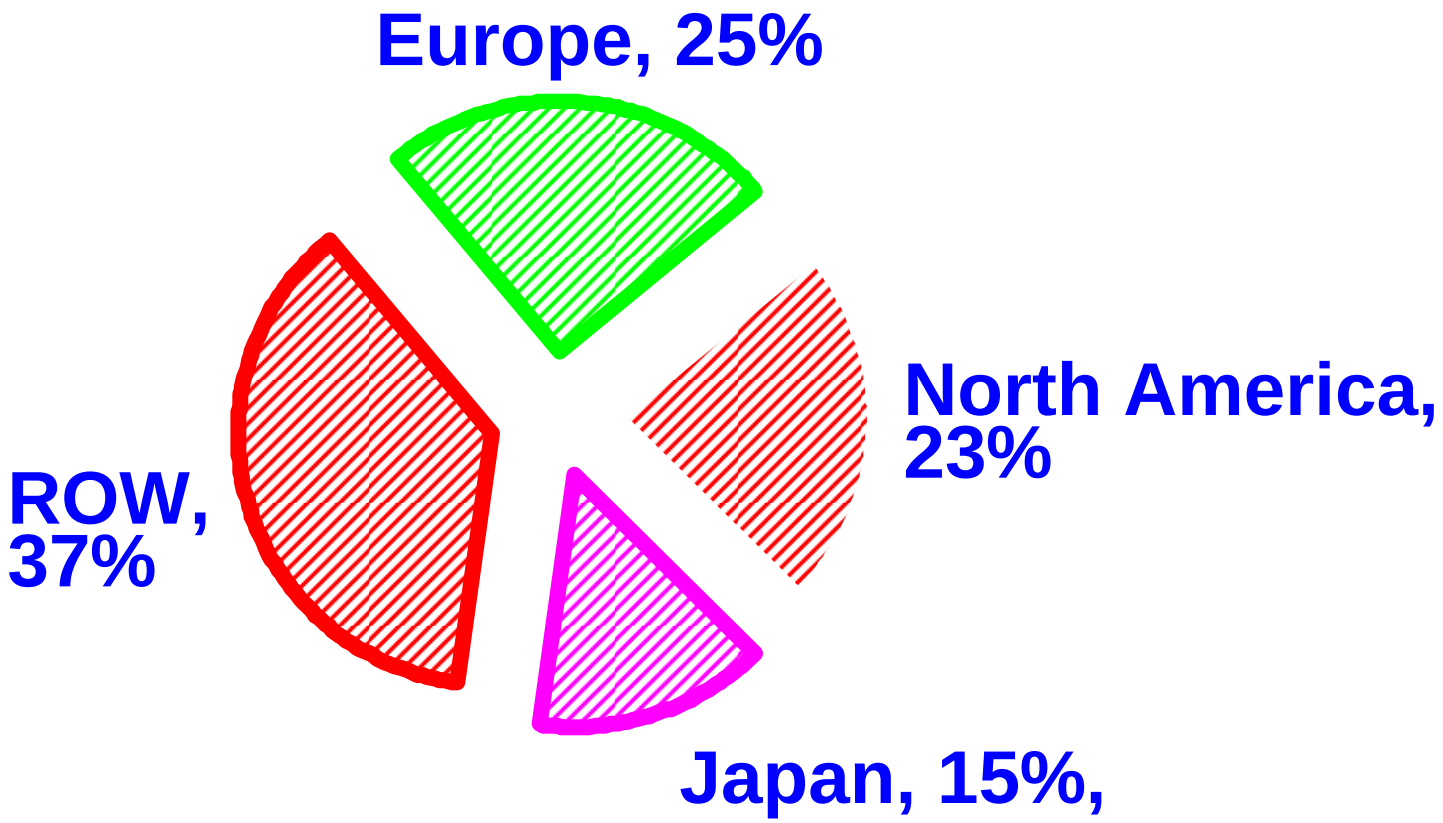
Global Market for Flexible Materials, by Region



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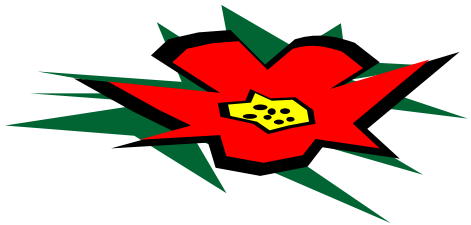
Total Demand of flexible materials, 2001 = 76,227 MM Lbs

The Role of TPEs?

Develop Products that will behave like Thermoset Rubbers using the Thermoplastic Processing methods

Benefits

- **Recyclability**
- **Less Need for Rubber Compounding**
- **Cost Savings due to Thermoplastic Processing**
- **Opportunities for Thermoplastic Compounders**



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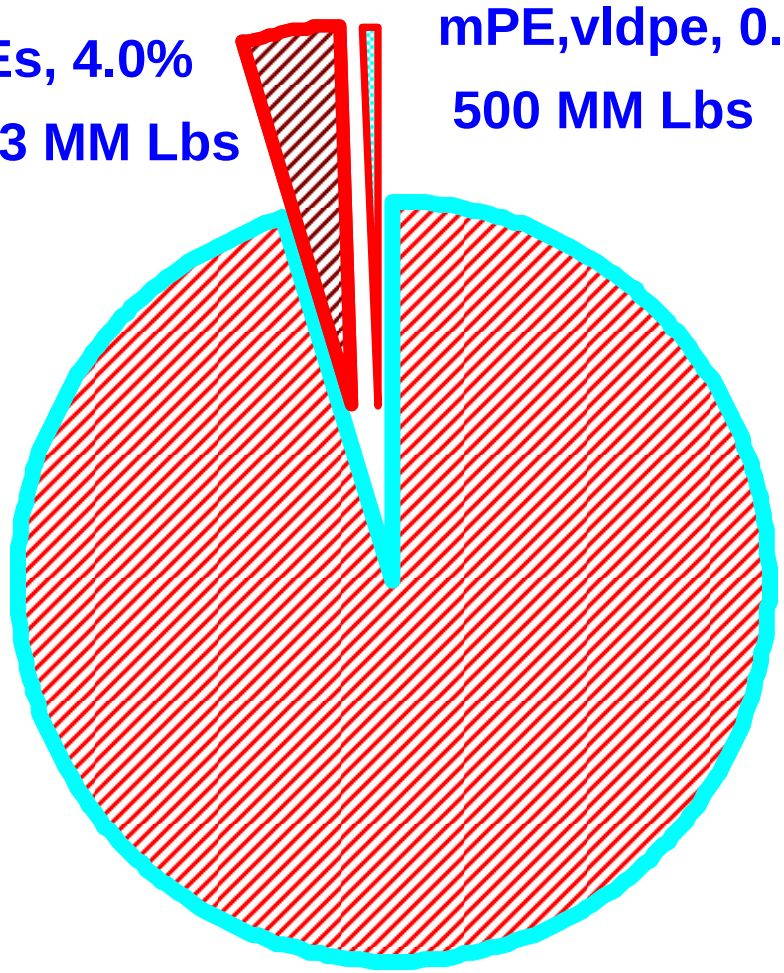

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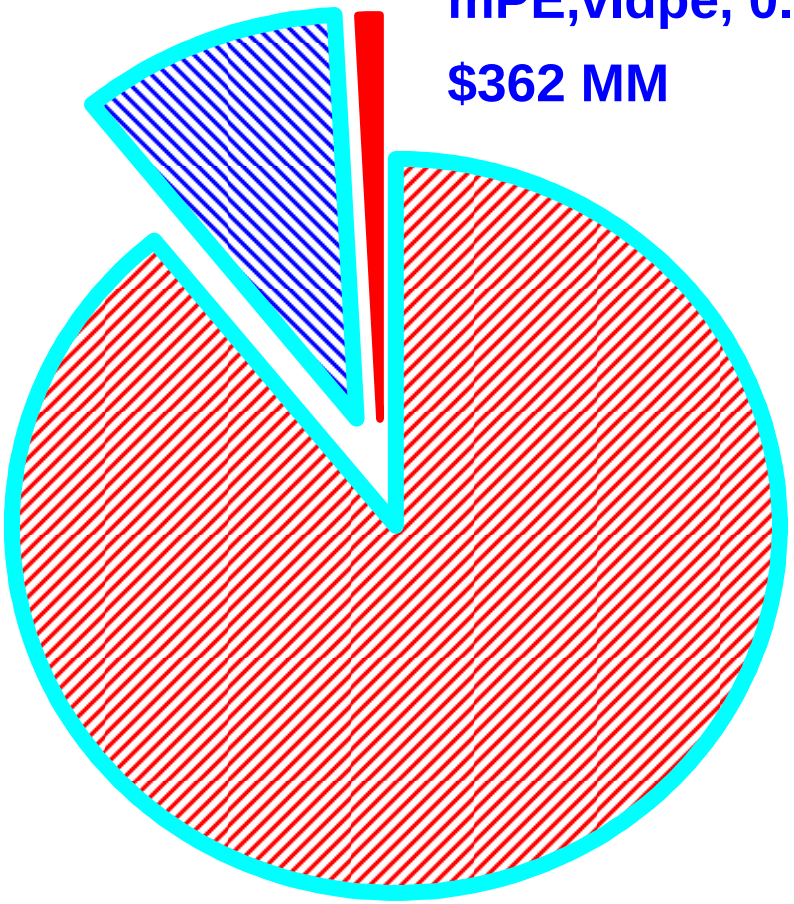
Global Market for Flexible Materials, 2001



Total Value of flexible materials, 2001 = $40,245 MM

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The Role of TPEs? – History

Pre 1980s

SB Copolymers – The Shell Game!

TPOs – Compounder Domain

Specialties – DuPont Innovation Cycle

1980s

- SB Copolymers' coming of Age
- TPVs – Monsanto Movement
- DuPont's MPRs - First Life Cycle
- RTPOs – Himont, DSM and others
- Realization that Compounders are Indispensable

The Role of TPEs? – History

1990s

- SB Copolymers – Transition to commodities
- TPOs – Boost From Automotive
- Specialties – Status quo and Reorganization
- New Technologies – Status quo

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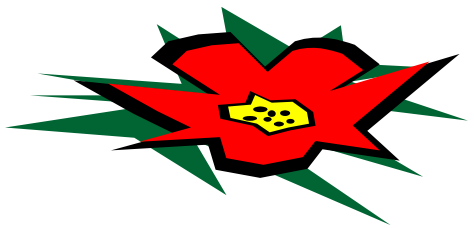
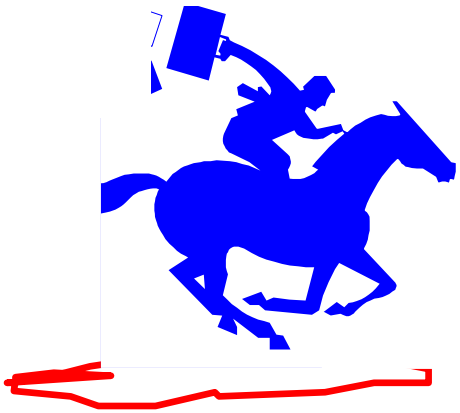
The Attention of TPEs was Diverted to
"Metallocenes" and Olefinic Elastomers
"Flexible PVC Opportunities"



The Role of TPEs – Current

- Continue to Bridge the gap between Thermosets and Thermoplastics
- Continue to Bridge the gap between reactor operations and compounding functions
- Focus on automotive and synergistic opportunities in others
- Impact of metallocenes and other polymerization technologies
- Watching Flexible PVC

The Three Criteria



- Specialty Index

-Market Attractiveness

-Required Business Position

Specialty Index

Specialty index is defined as the ombination of the following major attributes and the associated weights:

Profitability	40%
Demand	20%
Number of Players	15%
Price	15%
Technical Barriers	10%
	100%

Market Attractiveness

Market Attractiveness is defined as the combination of the following major attributes and the associated weights:

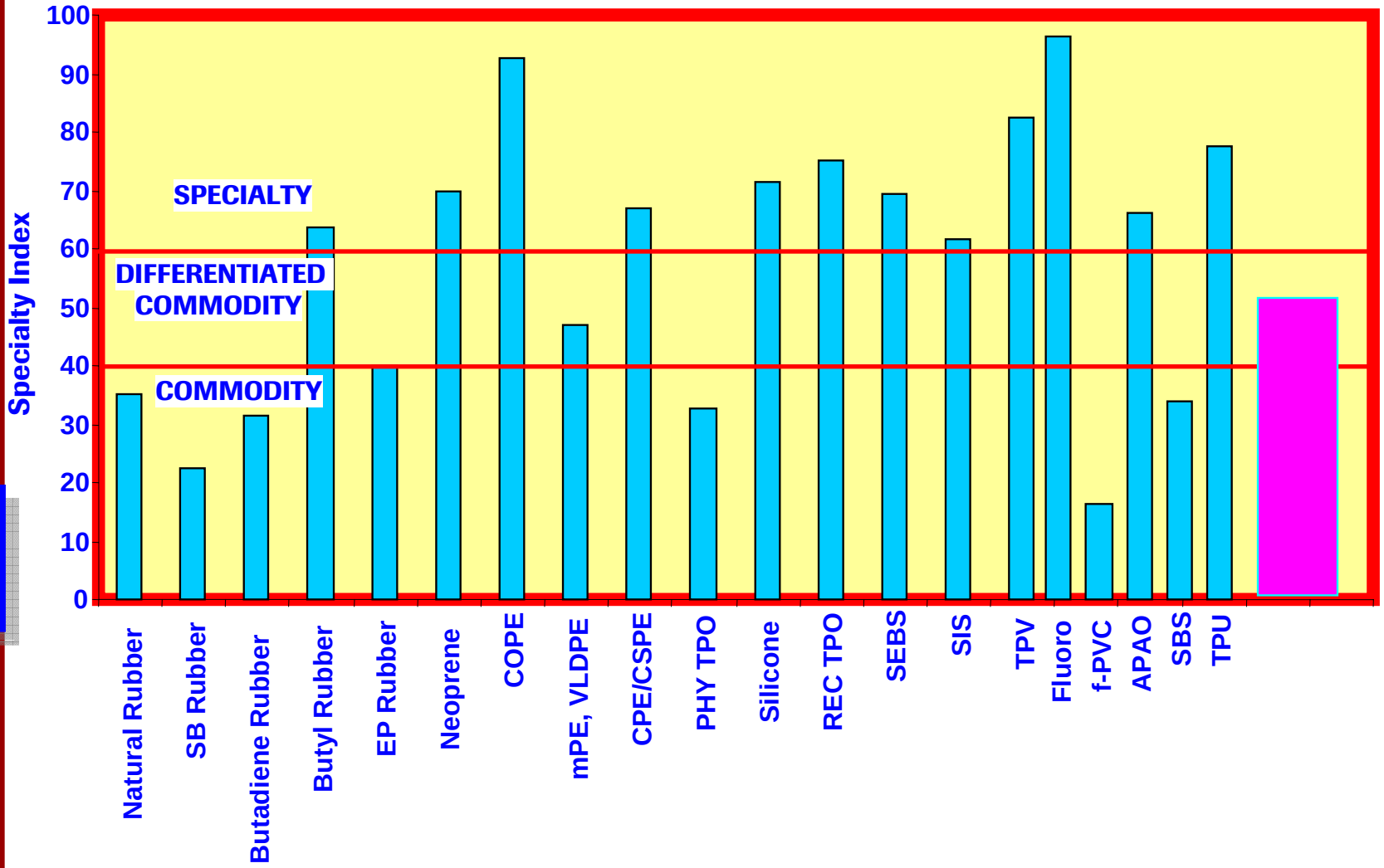
Market Size	30%
Market Value	30%
Growth Rate	30%
End Users	10%
	100%

Required Business Position

Required Business Position expresses quantitatively the difficulty of entering and staying in the market. It is a combination of the following major attributes and the associated weights:

Patent/Technology	40%
Technical/Sales Effort	25%
Low Cost Supplier	15%
Synergy	20%
	100%

Specialty Analysis for Flexible Materials



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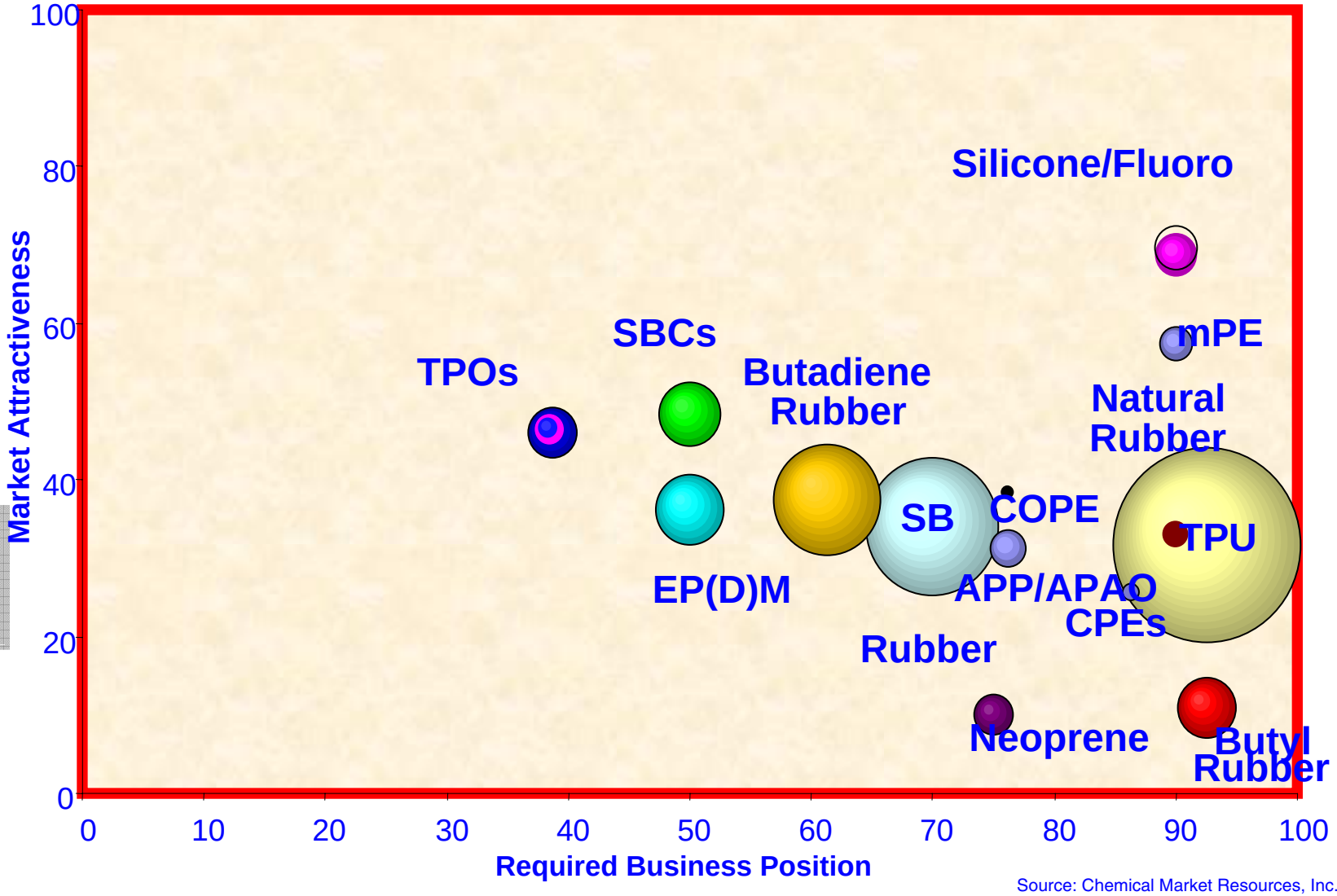
Market Attractiveness vs. Required Business Position

By Material



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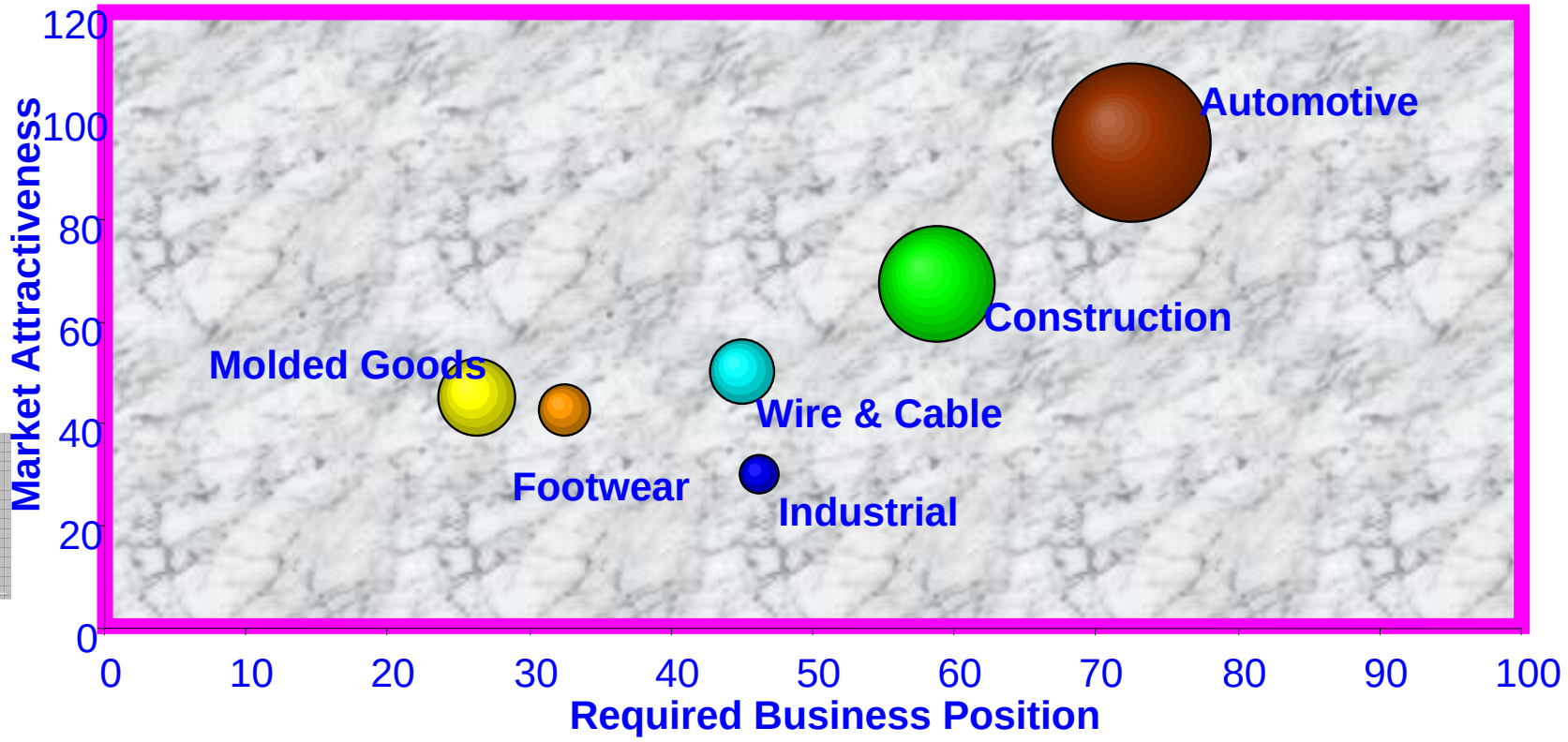
Market Attractiveness vs. Required Business Position

By Application



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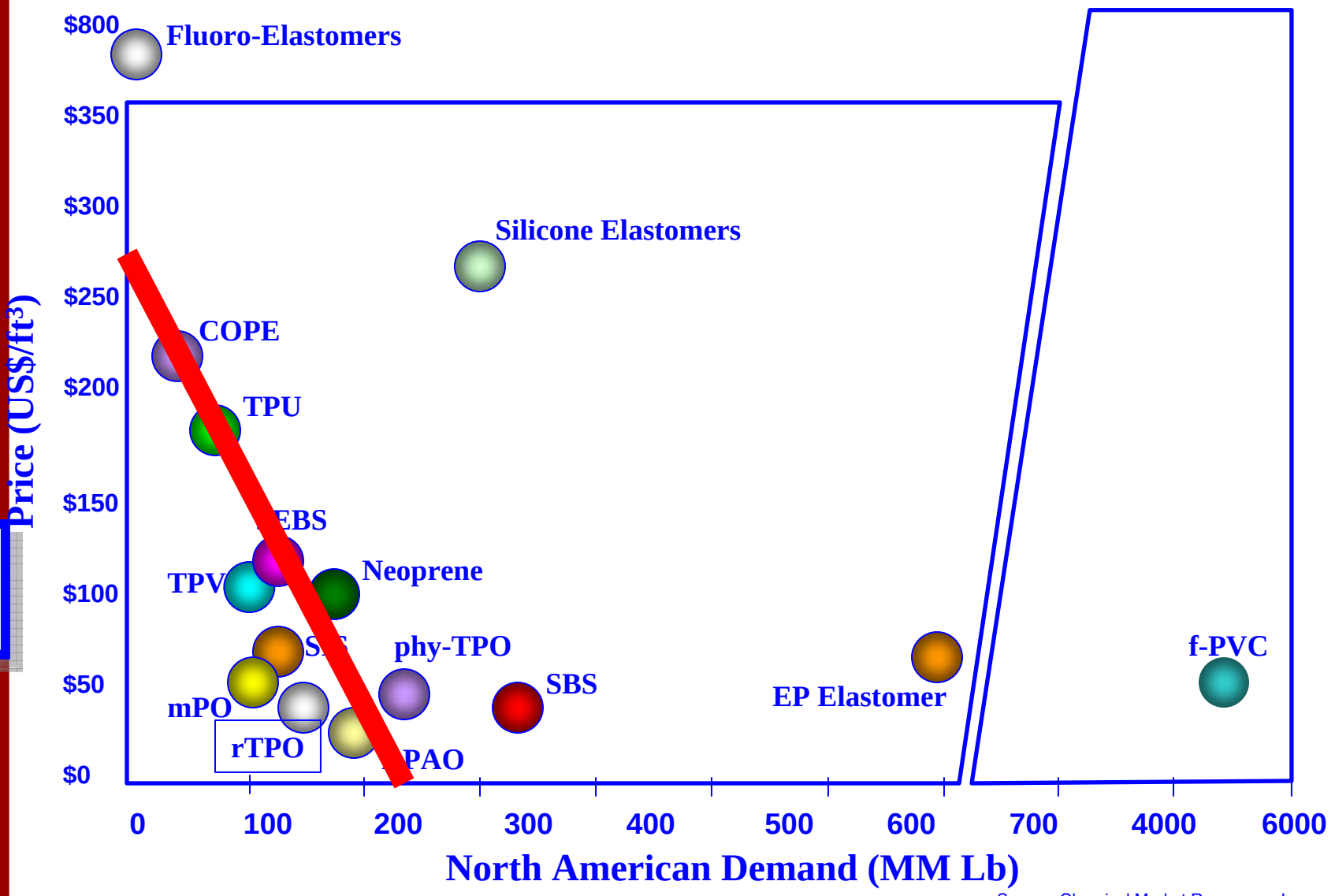
Price Elasticity of Demand - TPEs and Flexible Polymers



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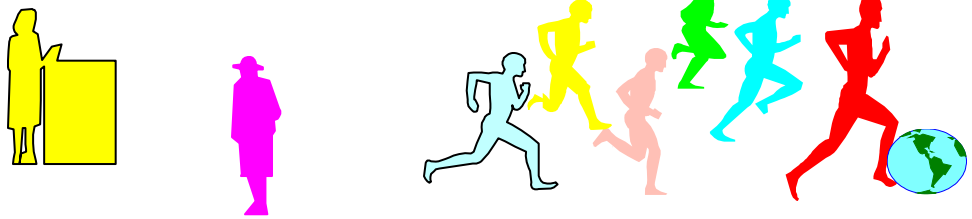
TPOs

High Volume Specialties

- Purpose : Providing an alternative to post-reactor processing
- Function: Impact properties
- The value addition is partly at the producer level – overall cost reduction is the key
- The end users have to optimize the shifting values – between producers and compounders
- Enablers - Technology and market understanding
- Long Term Threat – Cost Economics



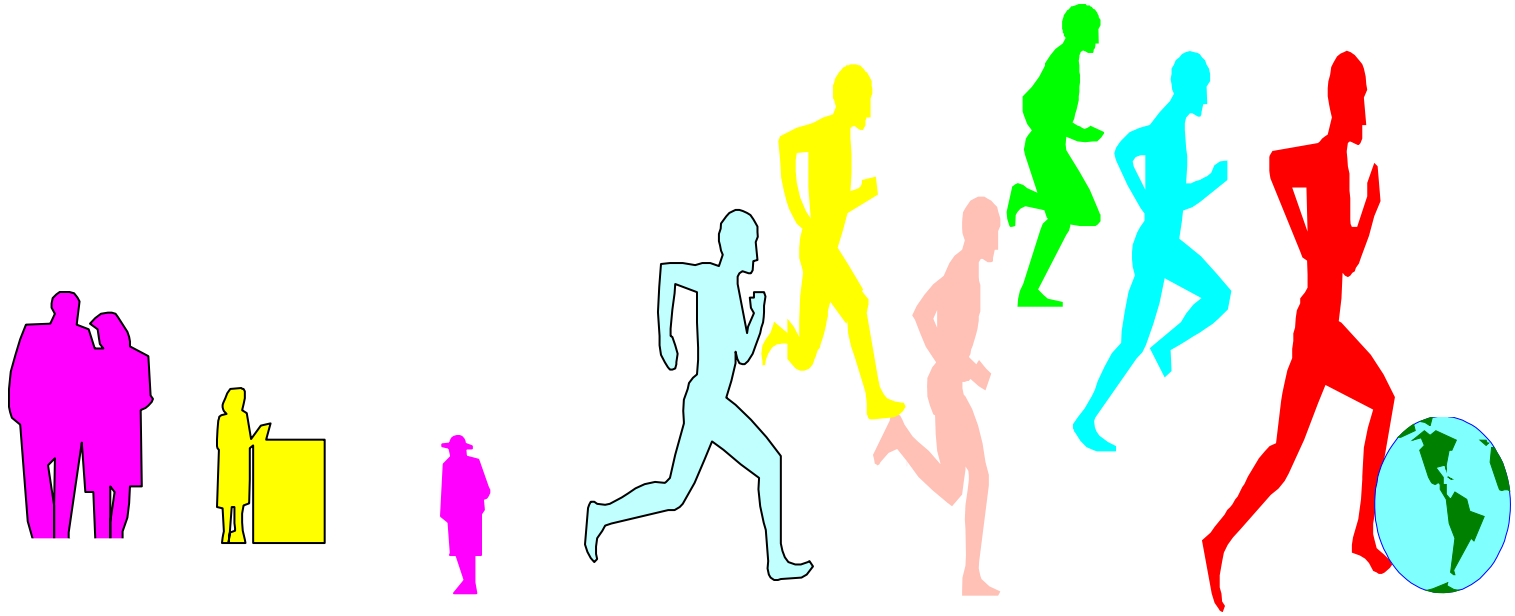
SB Copolymers

High Volume Specialties

- Purpose: The first commercial TPE
- Function: Impact and Compatibilization
- The value addition is at the producer level. New SBs – Kraton Polymers continuing the innovation of Shell
- Threats - SBS commoditization with no new end uses
- SIS – Limited End Uses
- SEBS – Impact of newer polyolefins
- Enablers: Polymer Technology and market position

Specialty TPEs

- Will remain specialties due to choice, industry structure and/or Cost/performance
- Technology and volume and market development will be the enablers



WHERE ARE WE HEADED?

Present and Future Status of Thermoplastic Elastomers

Material	Current Classification	Future Classification	Critical Driver / Limitation
PHY-TPO	Commodity	Differentiated	Volume
REC-TPO	Specialty	Differentiated	Volume
TPV	Specialty	Specialty	Cost Economics
SBS	Diff. Com.	Diff. Com	Volume/End Use
SEBS	Specialty	Specialty	Technology
SIS	Specialty	Specialty	Volume
COPE	Specialty	Specialty	Volume
Fluoro	Specialty	Specialty	Volume
TPU	Specialty	Specialty	Technology
Silicone	Specialty	Specialty	# of players

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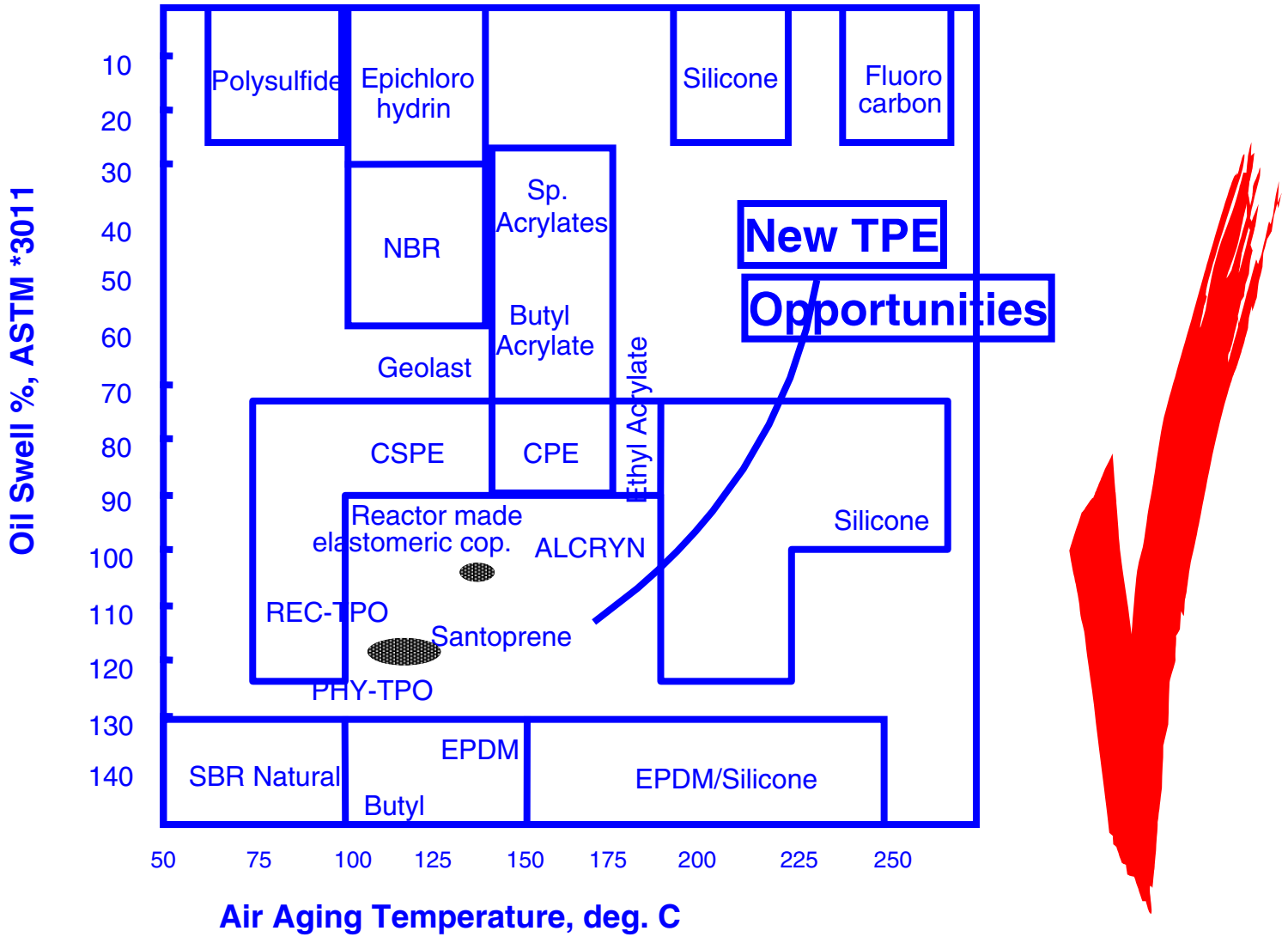
New Directions for TPEs?

- Historically, TPEs only focused on flex modulus aspects of Thermosets, except Geolast
- The other unmet needs
  - Clarity
  - Impact
  - Chemical Resistance
  - Polarity
  - Barrier properties
- The specialty products have been focusing on these unmet needs and will continue to provide the opportunities.



Conclusions

- *New TPE developments in the last decade have been diverted by other activities in the flexible polymer industry vis-à-vis Polyolefin Metallocenes, Industry Reorganizations, Focus on Flexible PVC...,*
- *TPEs have tremendous untapped potential in both markets and technologies. We have a long way to go..,*

FLEXPO 2002

September 18-20, 2002
Hilton - NASA, Houston, TX

The Seventh International Conference On

Polyolefins & Elastomers Intermaterial Competition Opportunities

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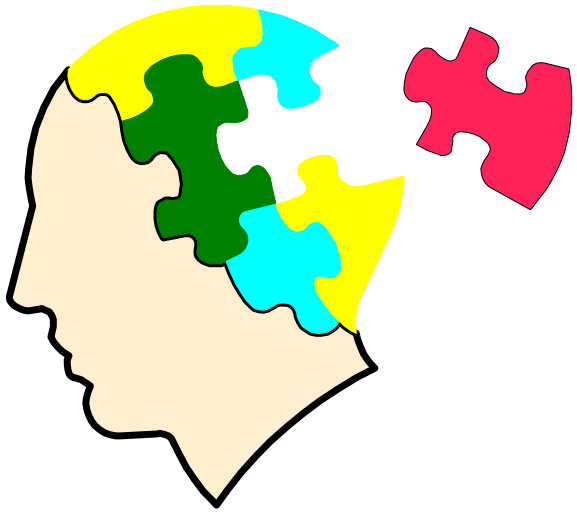

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