“The Ohio Polymer Industry”

Dennis Barber, Executive Director
Ohio Polymer Strategy Council
August 10, 2011
• Polymers are Ohio’s largest manufacturing industry

Other major market sectors use polymer materials for new, innovative applications and products.

• The industry is market driven and has a rich tradition of commercially successful innovation.
2011 Ohio is home to more than 2,400 polymer and advanced material companies.

2,160 of these companies have fewer than 100 employees.

These organizations are moving into new technology-based materials for growing markets.

Source of Graphic: Three Scale Research, LLC, February 2011
Appalachia

• Chemical/polymer industry dominant
  -- 21 chemical/polymer establishments
  -- > 4300 employees
  -- Global presence/opportunity
  -- Leverage Ohio location/value chain
  -- Experienced/trained work force
The Opportunity

- Focus on strengths/skills
- Cluster is in place – organize/action
- Collaborate with in-state partners
- Cleveland/Akron/Columbus
- Leverage the value chain potential
- Market the area/capabilities within industry
• Strengths
  – Complete, in-place, local
  – Multi-faceted
  – Low-risk, low cost
  – Stability
  – Custom capabilities
Assets in Ohio

Develop/commercialize

- Wright-Patterson AFB
- NASA
- University of Dayton Res. Inst.
- Kent State Liquid Crystal Inst.
- Battelle
- National Polymer Innovation Center
- Austen BioInnovation Inst.
- University of Toledo Polymer Inst.
- Ohio Supercomputing Center
OPSC and its Impact

• OPSC formed in 2001

• Gained major recognition and visibility of the polymer opportunities in Ohio
  -- 130,000+ employees
  -- $50B in annual shipments
  -- $3.5B in annual payroll
  -- Market and technology leadership
  -- Major role in gaining support for 4 Wright Centers of Innovation
  -- Secured more than $300M in OTF grants

• Ohio Polymer Strategic Opportunity Roadmap – 2004

• OPSC leads commercialization efforts and new collaborations across Ohio
Industry Dynamics

Four Major Thrusts

New Technology Commercialization (Opportunity)

Value Chain (Advantage)

Talent (Sustainer)
  - Train
  - Retain
  - Attract

Access to Funding (Enabler)
  - State
  - Federal
  - Private

Two Guiding Principles

Build on Strengths

Leverage Collaborative Efforts
Outcomes

• Multiple Strategies and Actions

• Key Technologies
  – Direct Digital Manufacturing
  – Advanced Computational Tools / Modeling and Simulation
  – Combinatorial and High-Throughput Methods
  – Biomass Conversion to Chemical Feedstock
New Technology Commercialization – (the Opportunity)

Key Market Areas:
- Alternative/Renewable Energy
- Automobile, Aerospace & Defense
- Biomedical
- Building Materials
- Electronics (flexible electronics)
- Packaging
Key Market Areas:

- **Alternative/Renewable Energy**
  - Nano coatings for increased solar cell efficiency
  - High strength to weight ratio composite wind blades but costs must be reduced
  - Weather resistant coatings and erosion resistant adhesives maximize productivity
  - "Smart" polymer materials and coatings being used for blade reliability
New Technology Commercialization – (the Opportunity)

Key Market Areas:

- **Automobile, Aerospace & Defense**
  - Light weight protective gear and flame retardant fabrics for defense
  - Strong growth for sealants (noise) and adhesives (weight savings) in automotive
  - Bio-plastics and other sustainable materials for automotive
  - High value, high performance bio-based engineering polymers will continue to gain
New Technology Commercialization – (the Opportunity)

Key Market Areas:

- **Electronics (flexible electronics)**
  - Flexible chips must be durable and reliable to replace silicon
  - Roll-to-roll manufacturing consistency and improved performance needed to be a force in printed electronics
  - Organic Light Emitting Diodes (OLEDs) are polymer film layers and could be a major factor in flat panel displays (longer life required)
Overview of Key Opportunity Areas

- Bio-based Feedstocks/Bio-Polymers
- Conductive & Electronic Polymers
  - Liquid Crystal Polymers
- Polymer-Nanocomposites
- High Performance Polymers
  - Fiber-reinforced composites
- Degradable/Recyclable Polymers
# Overview of Key Opportunity Areas

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<td>Conductive Polymers</td>
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<td>Liquid Crystal Polymers</td>
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<td>Flexible Printed Electronics</td>
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<td>Polymer Nanocomposites</td>
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<td>214K MT</td>
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<td>Nanocoatings/Nanoadhesives</td>
<td>$2.3b</td>
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<td>$19.1b</td>
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<td>High-performance Polymers</td>
<td>$6.1b</td>
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<td>Biopolymers</td>
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<td>2.7 million tons</td>
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<td>Biodegradable Polymers</td>
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Thank you
## Strategies

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<th>New Technology Commercialization</th>
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<tr>
<td>• Upgrade polymer research infrastructure to pursue key opportunity areas</td>
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<tr>
<td>• Establish efficient mechanisms to increase commercial success rates for emerging technologies</td>
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<td>• Increase the speed of new technology commercialization</td>
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<th>Value Chain</th>
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<td>• Strengthen value chain in Ohio by improving competitiveness of small-to-medium sized manufacturers</td>
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<td>• Increase the number of collaborative projects by identifying productive partnerships across the value chain, reducing time to market for new technologies and advances in existing technologies</td>
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<th>Talent</th>
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<td>• Strengthen existing infrastructure to ensure the established manufacturing talent is capable of leveraging new technologies</td>
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<th>Funding</th>
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<td>• Increase access to state, federal and corporate funding</td>
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<td>Pillars</td>
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<tr>
<td>1. New Technology Commercialization</td>
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<td><strong>2. Value Chain</strong></td>
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• Polymers are the materials used to create a competitive advantage, revenue growth and new jobs.
• Ohio’s economic health is highly dependent on an innovative and healthy polymer and materials sector.
• Companies have growth initiatives underway but need leadership and competitive support from the state.

Conclusion
## U.S. Petroleum Market
*(The Value Addition in Advanced Materials)*

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<tr>
<th>Use</th>
<th>Value</th>
<th>Value/Share</th>
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<tr>
<td>≈ 67% transportation fuel <em>(auto, air, truck, rail, etc)</em></td>
<td>$350 billion</td>
<td>$5.2 billion</td>
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<tr>
<td>≈ 7% materials <em>(chemicals, polymers, etc)</em></td>
<td>$255 billion</td>
<td>$36.4 billion</td>
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• Ohio’s polymer industry sustains its global leadership in polymers, advanced materials and bio-based materials products, processes and services. Companies grow and prosper through the development and adoption of new technologies. Growth companies and talented people are attracted to Ohio because the business advantages of collaborative excellence focused on commercial growth are clear. New technology commercialization, product and process innovation, and value chain collaboration have been institutionalized as business processes.
• Build on Ohio’s strengths of proven innovation, research universities, public and private laboratories and institutes, access to a broad array of markets and a skilled workforce to enable Ohio’s polymer industry to achieve a position of global leadership. Engage and mobilize industry innovators through collaboration to grow existing companies and form new companies that provide high value-added products and services to growing markets. Attract and retain world-class talent through consistent evidence of emerging technology commercialization and industry growth.
Funding (The Enabler)

• Private / Corporate
  – First/Best option
  – Individual company
  – Venture capital
  – Foundation

• Public Funds
  – A necessary catalyst
  – ODOD in transition
  – ROI potential will be important
  – Opportunity for custom collaboration/benefits
Talent (the Sustainer)

- **Train**
  - Intern programs
  - Curriculum changes
  - Ongoing distant learning

- **Retain**
  - Institutes/Laboratories (AFRL, NASA, Battelle, UDRI, LCI)
  - Industry innovation
    - (Zyvex, Venture Plastics, PolyOne, Andersons, PTI, APS)
  - World-class universities (2 out of top 3)

- **Attract**
  - Nature of work - Personal growth
  - Peer collaboration - Support to innovation
Key Market Areas:

- **Biomedical**
  - Renewable, recyclable materials for disposable medical products
  - Medical adhesives for implantables
  - Equipment will use “benign” chemicals, coatings and sealants and renewable materials
  - Biofilms will be used for timed release antibiotics and bacterial resistance
Key Market Areas:

- **Building Materials**
  - Cast polymers provide increased durability and design flexibility
  - Composites (shingles, siding) for improved durability, shape, color
  - Flame resistant polymers
  - Residential attributes - easy to customize, cost, durability
Key Market Areas:

- **Packaging**
  - A $400B market; sustainability growing in importance
  - Flexible packaging and single serve packaging are growing
  - Protective packaging seeing major growth due to retail sales on internet
  - Opportunity in custom resins with aesthetic and/or design advantages
<table>
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<tr>
<th>Pillars</th>
<th>Strategies</th>
<th>Actions</th>
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<tbody>
<tr>
<td>3. Talent</td>
<td>1. Strengthen existing infrastructure to assure the established</td>
<td>1. Expand online learning degree programs at universities offering</td>
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<tr>
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<td>manufacturing talent is capable of leveraging new technology.</td>
<td>polymer-related programs</td>
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<td>2. Create a pool of innovative workers that would support the needs of</td>
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<td>21st century businesses, through incenting early linkages between</td>
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<td>students pursuing science degrees and the technology businesses within</td>
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<td>the polymer industry</td>
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<td>3. Develop innovative online tools and programs for the incumbent</td>
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<td>workforce training and development</td>
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<tr>
<td>Pillars</td>
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<tr>
<td>4. Access to Funding</td>
<td>1. Increase access to State, federal and corporate funding.</td>
<td>1. Increase availability of seed and venture capital to commercialize technologies in polymer and advanced material area</td>
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<td>2. Create a $30 million polymer and advanced material focused venture capital fund with funding support from state and industry corporate group</td>
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<td>3. Launch marketing campaigns to portray Ohio’s strengths and leadership in the industry</td>
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<td>4. Increase advocacy with federal agencies and increase their awareness of Ohio’s polymer industry, its strengths and capabilities</td>
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Background

- Thought Leadership Forums
- OPSC Meetings
- Phone Interviews / Visits
- 3 Industry Surveys

Process
Strategic Program Development

- Identify Opportunities
- Review Resources
- Develop Programs

Strategic Program Development