

CMEC Carpet Research

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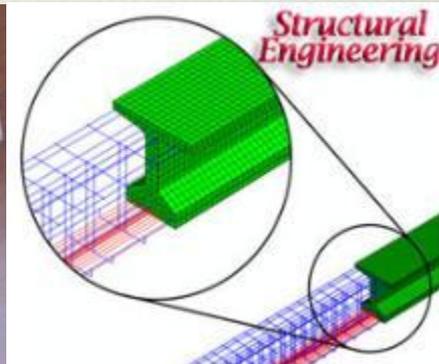
WSRA Meeting
6/21/12

Outline

- ❖ Brief background of CMEC
 - ❖ Applied research and outreach
- ❖ Carpet Research at CMEC
 - ❖ Research Projects
- ❖ Potential Avenues for recovered nylon, PET

CMEC

- ❖ We develop novel infrastructure materials and innovative building systems and design methodologies to effectively utilize new materials
- ❖ Organized around core capabilities:
 - ✓ Wood and natural fibers
 - ✓ Polymeric materials
 - ✓ Cementitious and bituminous materials
 - ✓ Structural engineering
- ❖ \$2M/yr research expenditures
- ❖ Current student enrollments
 - ❖ Graduate Students – 30+
 - ❖ Undergrad Assistants – 5+



Overarching research & outreach areas

Biomass utilization

- ❖ composites
 - ❖ processing, product performance
- ❖ bio refinery
 - ❖ biomass refinement, co-products, integrated technologies
- ❖ under utilized
 - ❖ mill waste, MSW, small diameter timber



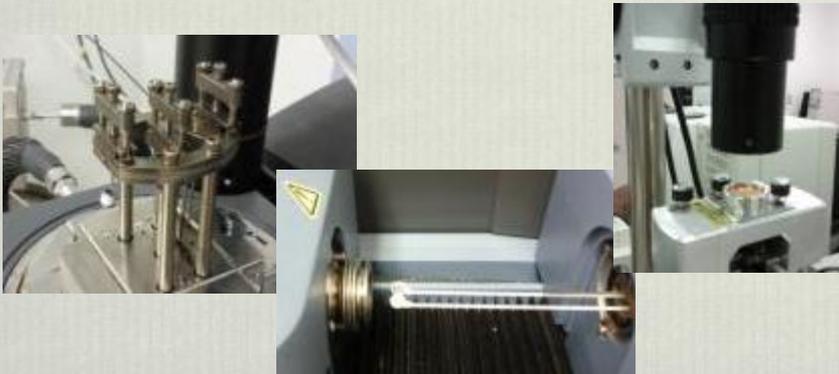
Process engineering

- ❖ composite design
- ❖ process innovation & improvement
- ❖ biocomposites, hybrids
- ❖ net-shape design



Material characterization

- ❖ thermal, physical, chemical



Building science

- ❖ performance-based design
- ❖ energy efficiency
- ❖ codes and standards



Industrial outreach

- ❖ Materials Processing/Testing

- ❖ 100+ companies
- ❖ National/International
- ❖ Extension R&D

- ❖ Opportunities

- ❖ Relationship building
- ❖ Network
- ❖ Synergies with WA-based companies
- ❖ Grant collaborators



Plastics to fuels

- ❖ Turn waste plastics to oil

- ❖ Not incineration for energy

- ❖ Commercial ventures

- ❖ Envion

- ❖ (www.envion.com)

- ❖ Agilyx

- ❖ (www.agilyx.com)

- ❖ Plastic2Fuel

- ❖ (www.plastic2fuel.com)

- ❖ Many more.....

- ❖ Thermal cracking

- ❖ plastic – melt – gas – condensed oil

- ❖ Generate heat on site

- ❖ Little emissions w more sophisticated technologies

- ❖ Ideally

- ❖ Not the best solution

- ❖ Recycled???

- ❖ Realistically

- ❖ Best solution we have

- ❖ Esp mixed streams

Carpet to fuel

- ❖ Community Energy Systems
 - ❖ High density feedstock

- ❖ Improve...
 - ❖ Transportation costs
 - ❖ Process efficiency



5-10 lb/ft³



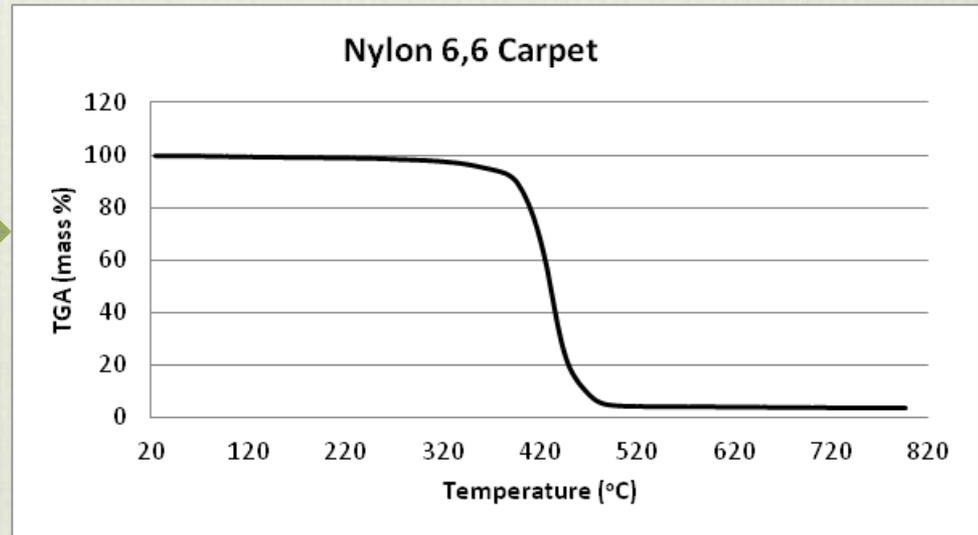
18-22 lb/ft³



60+lb/ft³

Adding value to PC carpet waste

- ❖ Recovery 1
 - ❖ Separate the fibers
 - ❖ Clean the fibers
- ❖ Densification
 - ❖ Transportation
 - ❖ Feedstock uniformity
 - ❖ Increase \$\$



- ❖ Empower MRFs
 - ❖ Bring value to local level
 - ❖ Increase recovery
 - ❖ Support local economies

Pellet production

Feed stock densification

Melt-densification



Carpet to building materials

- ❖ Current Client
 - ❖ Building material market
 - ❖ Still in R&D mode
- ❖ CMEC Responsibilities
 - ❖ Processing and testing



Synthetic carpet fibers

❖ Nylons

- ❖ Tough
 - ❖ Wear resistance
- ❖ High Temperature performance
- ❖ Cost – higher than PET
- ❖ Hydrolysis degradation
 - ❖ In service - acids
 - ❖ Processing - water

❖ Polyethylene

Terephthalate (PET)

- ❖ Not as tough
- ❖ High stain resistance
- ❖ Excellent barrier performance
- ❖ Good recycling potential
 - ❖ Dominant bottle polymer
- ❖ Cost – lower than nylons

Potential Products

❖ Nylons

❖ Back to carpet

- ❖ Nylon 6
- ❖ Zeftron 6ix Again recycling program
 - ❖ Shaw industries

❖ Clothing outerwear

❖ Automobile parts

- ❖ Cylinder head covers, oil pans, battery housing
 - ❖ Ford, Mercedes, Chevrolet, etc..

❖ PET

❖ Carpet

- ❖ Bottles and packaging
- ❖ Food-grade??

❖ Calcium Carbonate

- ❖ Inorganic filler for
 - ❖ Polymer, cement industries

❖ Polypropylene

- ❖ Vast array of molded composites



Questions?

Composite Materials and
Engineering Center

Washington State University

<http://www.cmec.wsu.edu/>

