Eastman Cyphrex™ microfibers

designed for wet laid nonwoven & paper processing
Co-Authors

John Allen, Ph.D (Right)
Senior Research Associate,
Microfiber Applications Development

Keh Dema (Left)
Technology Associate,
Microfiber Applications Development
Topics

- Background on microfibers
  - Characteristics of Cyphrex™ microfibers
  - Differences between Cyphrex™ microfibers and most known synthetic fibers
    - Formation
    - Strength
    - Permeability

- Attributes of Cyphrex™ microfibers in wet laid nonwovens
  - Incline wire paper machine (Incline Wire)
  - Fourdrinier paper machine (Fourdrinier)
  - Compare samples from incline wire and Fourdrinier

- Potential applications

- Conclusion
Background

**Current**

*non-fibrillated synthetic fibers for wet laid*

- minimal wet strength without bonding agents
- minimal dry strength without bonding agents
- cannot be dispersed above 1% consistency without significant chemistry

**Cyphrex™ microfibers**

*potential to change everything…*

**Cyphrex™ can be**

- conveyed on the wet end of the machine without bonding agents
- dried with enough bond strength to prepare a roll good
- dispersed from 1 to 3.2% consistency similar to wood pulp
Eastman Cyphrex™ microfibers

Microfiber precursor

Fiber processing

Eastman Cyphrex™ microfiber slurry

Wet-laid nonwoven processing

Media

50 microns
1. This novel flat fiber has a ribbon-like cross section

2. Dimension
   - 2.5 microns nominal thickness
   - 18 microns nominal width
   - 1.5 mm length

3. Supplied as a wet pulp at 50% solids

4. Forms highly uniform wet laid nonwoven papers
   - flat microfibers oriented parallel to media surface
   - high inter-fiber surface for bonding
   - high sheet surface smoothness
Cyphrex™ microfibers behave \textit{differently}…

1. Disperses easily in water with minimal shear energy
2. Compatible with traditional paper mill dispersion equipment
3. Accessible dispersion consistencies range up to 3.2%
4. Processes well at desired headbox consistencies for a wide range of forming equipment – including incline wire, rotoformer, and Fourdrinier
5. Inherent wet green strength allows for producing of 100% PET sheet
6. Enables preparation of synthetic roll good without binder or wet end additives
7. Compatible with typical wet-strength agents – which have also been shown to significantly improve dry strength as well
8. Blends easily with other fibers – most notably, cellulose, synthetics, and glass
Uniformity attained with 15 gsm novel flat PET microfiber sheet

Photograph of handsheet

SEM top view

SEM cross section
Pulp and paper formation measurement
(80 gsm handsheets)

NBSK = Northern bleached softwood Kraft wood pulp
Typical strengths of 100% flat PET media
(produced on incline wire)
Effect of wet strength agent on 100% flat PET media (produced on incline wire)
Paper properties differ based on machine configuration (100% flat PET microfibers)
Blends of novel flat PET microfibers with cellulose fibers (produced on Fourdrinier)
Novel flat PET microfiber improves tear strength
(60 gsm media blends with cellulose on Fourdrinier)
Novel flat PET microfiber improves permeability
(60 gsm media blends with cellulose on Fourdrinier)

![Graph showing permeability vs. basis weight for different materials]
Choice of bonding agent can influence strength
(80 gsm flat PET fiber sheets with 10% added binder)
Potential applications

Our fibers enable papermakers to produce high-performing, high-strength synthetic nonwovens on standard papermaking equipment.

- High strength paper – packaging, etc.
- Wall cover

Other applications
- Filtration – RO and FO membrane support
- Battery separator – Lithium ion, Lead acid, etc
Conclusion

Cyphrex™ Flat PET microfibers:

1. Process at consistency similar to wood pulp
2. Can be processed on the flat Fourdrinier, Incline Wire, or Rotoformer
3. Produce highly uniform sheets with high green strength
4. Blend well with other synthetic fibers as well as wood pulp at any ratio

- Preliminary studies suggest that paper made with this synthetic fiber are easily printable without exotic pretreatment
- The unique properties that this fiber imparts to substrates can create opportunities for many applications
Next step

Contact us for further discovery, sampling, or development conversations.

Email: pdulick@eastman.com
Phone number:
1-800-Eastman or 1-423-229-3910

Visit website:
http://www.eastmancyphrex.com