Internship Presentation

Kerianne Dobosz

Functional Materials Fellow Intern
TDL: Wei Cai TOL: Dave Moore
Project Leads: Andrew Burns & Matt Misner
UMass Amherst Ph.D. Candidate

June 5th – August 18th (11 weeks)

GE Global Research Center
Niskayuna, NY

Film Development

+

Extreme Environment Testing

→

Herceptin trastuzumab
HUMIRA adalimumab
Remicade INFLIXIMAB

Biopharmaceutical Production

About Me

- Born in Seoul, South Korea
- Grew up in Rochester, NY
- Cornell University – B.S./M.Eng. Chemical Engineering and German Minor

  Society of Women Engineers (SWE), P&G internships

  Computational Modeling Breast Cancer Research: Prof. Jeff Varner

  Nano Organic Hybrid Materials: Prof. Lynden Archer
- University of Massachusetts, Amherst - Ph.D. Chemical Engineering

  Graduate Women in STEM, Graduate Student Senate,

  NIH Biotechnology Training Program
- Outdoor activities, music

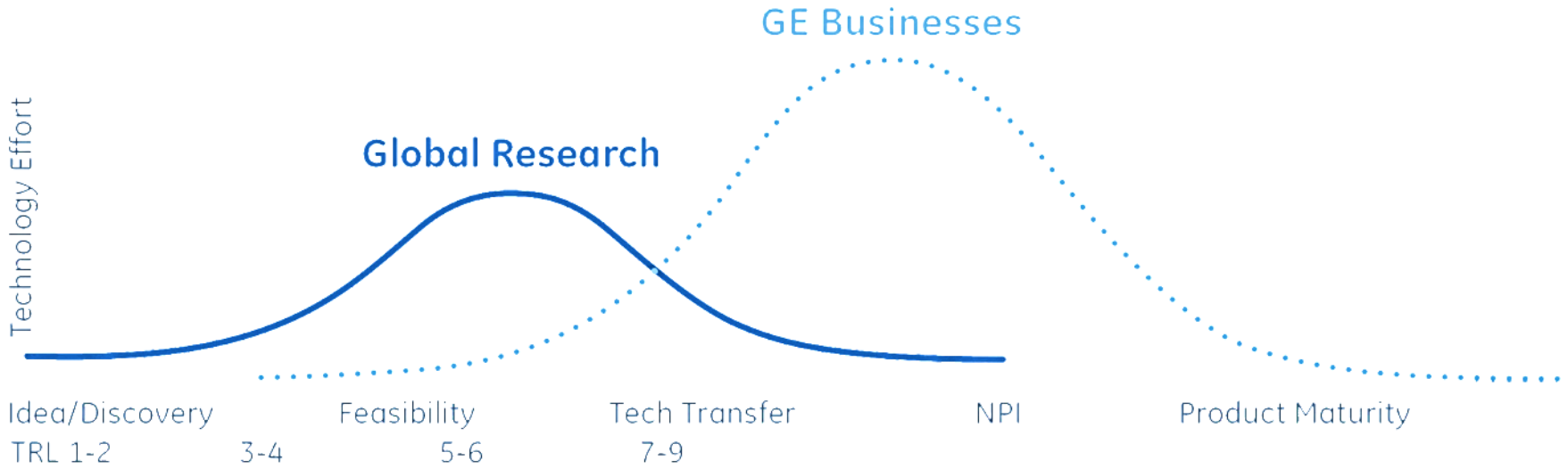
GE Global Research Charter: "Drive breakthrough technology to give GE competitive advantage"

GE's First U.S. industrial lab, founded in 1900 in Niskayuna, NY

1800 scientists/engineers, nearly two-thirds PhDs

- One of the world's most diversified industrial research organizations, providing innovative technology for all of GE's businesses

Innovation & Transition to Product



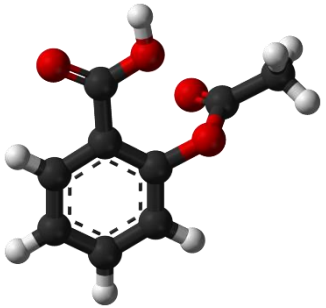
Global Research develops technology and product concepts from idea through prototype phase to transition to GE businesses

High risk, high reward research to accelerate GE business product development

Evolution of pharmaceuticals

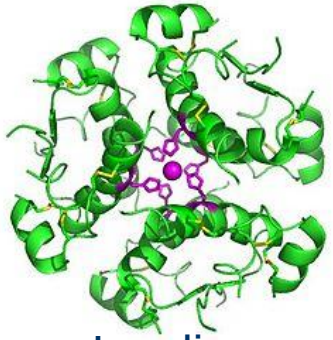
Cinchona bark (quinine)

Natural medicine
(e.g., herbs, minerals, quinine, opium)



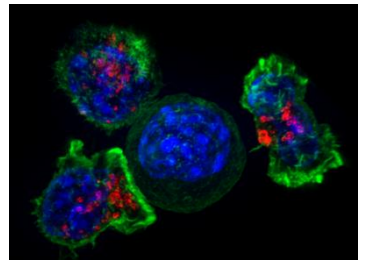
Aspirin

Synthetic small molecules
(e.g., penicillin, NSAIDs, opioids)



Insulin

Biopharmaceuticals
(e.g., insulin, hormones, antibodies, vaccines)



T-Cell

Cell therapies
(e.g., T-cells, iPSCs, MSCs)

Increasing complexity and evolving production needs

Monoclonal Antibody (mAB) & cytokine treatments for:
- Cancer Therapy
- Autoimmune Diseases

Herceptin® trastuzumab
AVASTIN® bevacizumab
HUMIRA® adalimumab

$187B (2015) – projected $271B (2020)

Biopharmaceutical production

Traditional Pharma (Stainless Steel)

Single Use Disposable (Plastic)

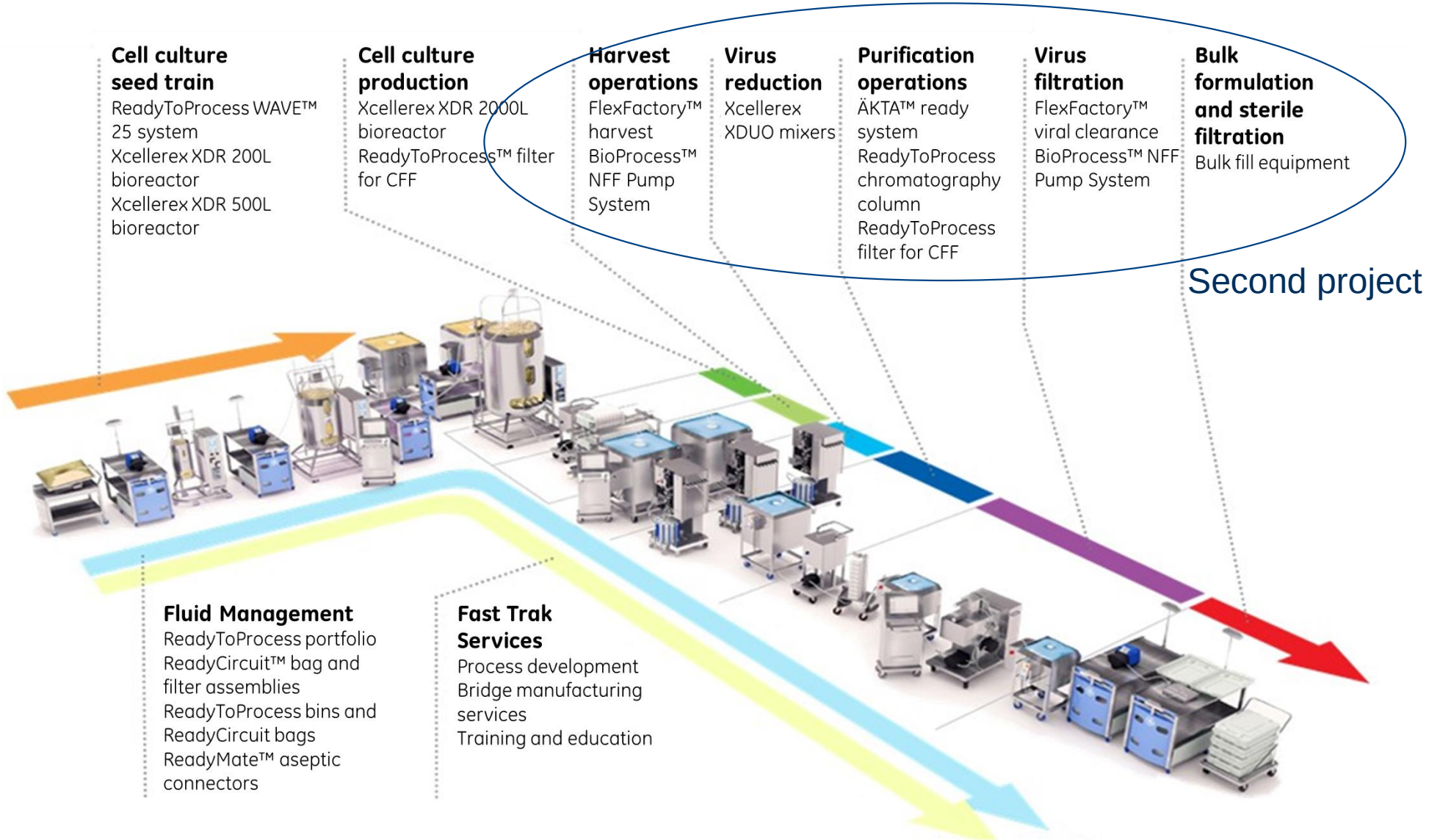
- Greater flexibility & scalability
- Smaller footprint

- Lower capital cost
- Lower OpEx cost
- Less water & energy use

Desired properties:

Performance - O_2 /CO_2 barrier, Flex, RT mechanicals, E&L,
Biocompatibility
Manufacturability-Seal strength, Processability, γ-stability, Optical Clarity

GE Healthcare SUD Portfolio



Fortem ™ Single Use Film Materials

Current GEHC Life Science Portfolio

HyClone Media Bags
Films: CX5-14 & Aegis

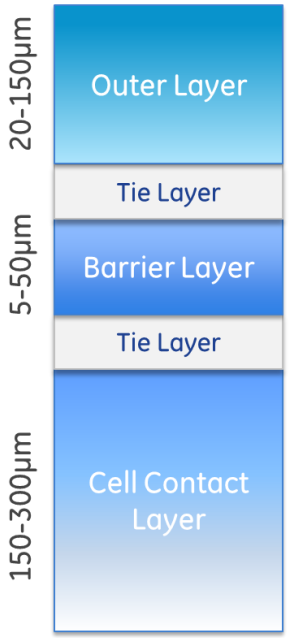
GE WAVE Bioreactors
Films: BioClear™ 10 & 11

GE ReadyToProcess™/ ReadyCircuit™
Film: ReadyKleer™

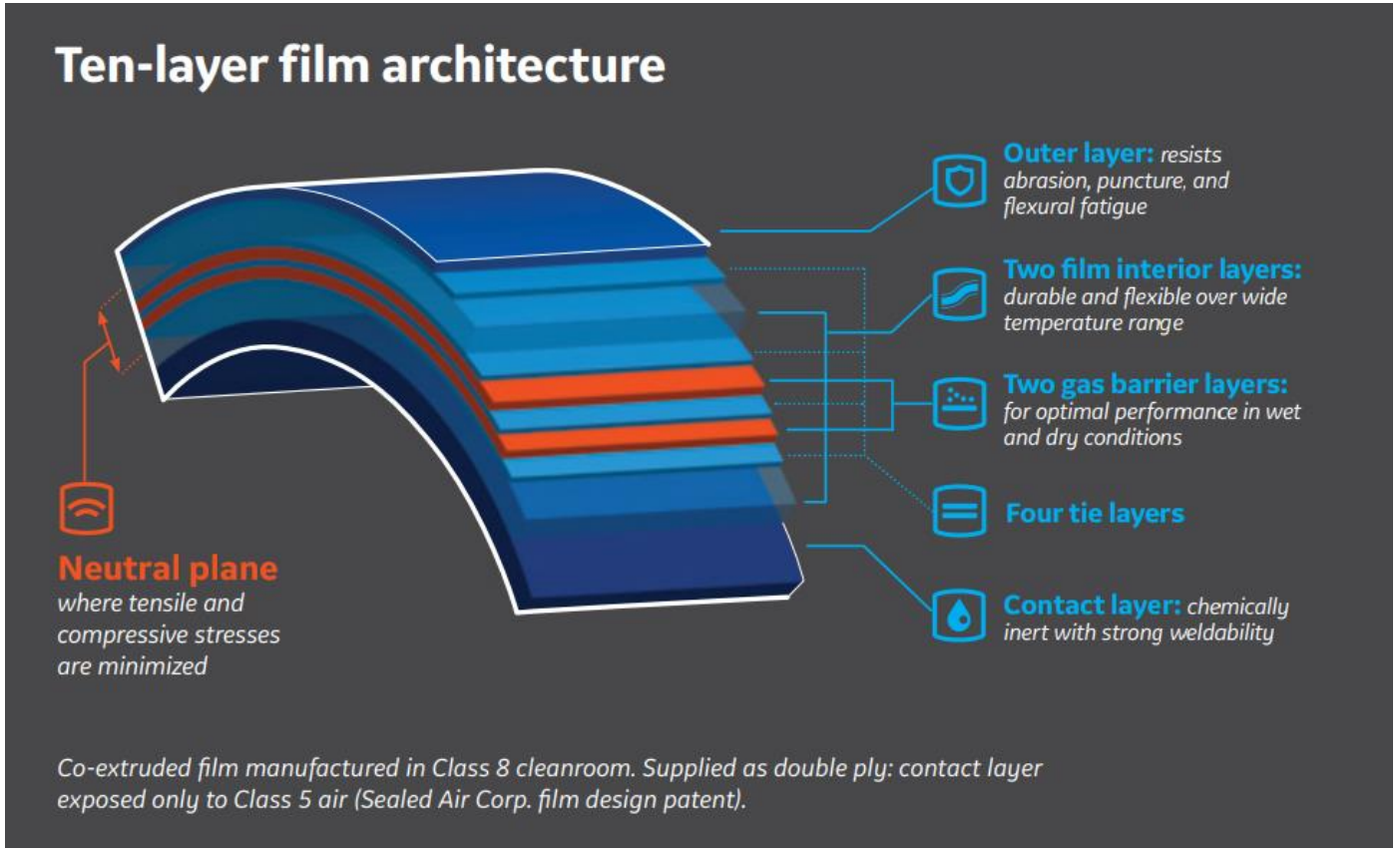
GE Xcellerex
Films: Marshall & ReadyKleer™

Fortem™ to consolidate film portfolio to a single contact surface in current SUD workflows

Materials Science of Film

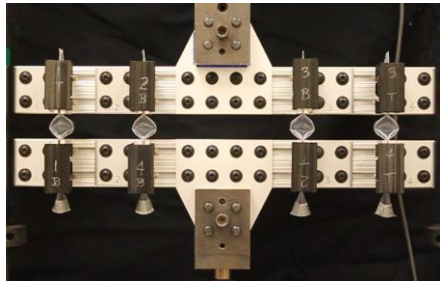


- Outer Layer
  - Mechanical robustness (tear, puncture, toughness)
  - Flexibility, Feel
- Barrier Layer
  - Low Oxygen Permeability
- Cell-contact layer
  - Biocompatibility
  - Minimal Extractables & Leachables
  - Sealing Capability

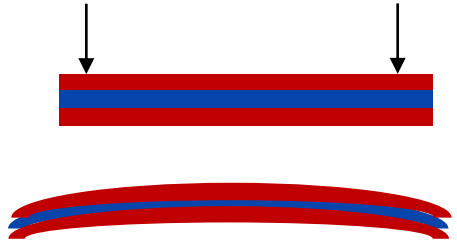


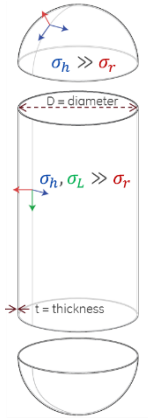
Test Development & Film Analysis

Goal: Analyze & understand real-world failure modes to develop bench-scale models and enable rapid, reproducible testing for material capabilities

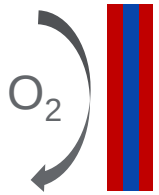


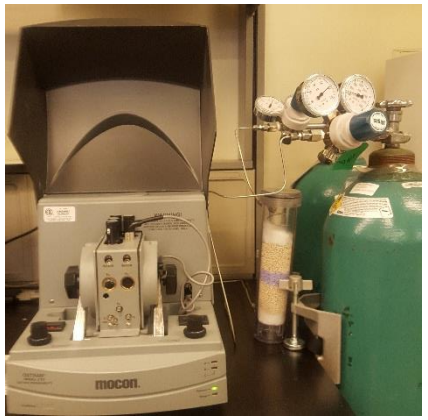
Flex Fatigue



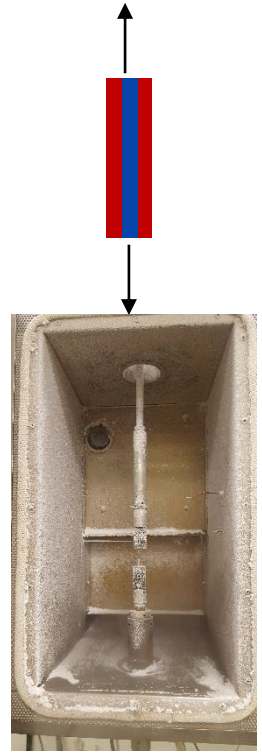


Bending & Bag Stress Modeling



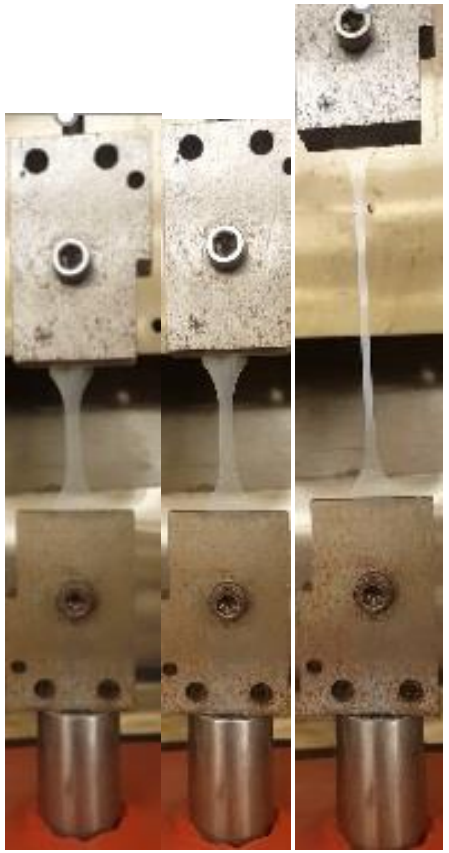


Oxygen transmission



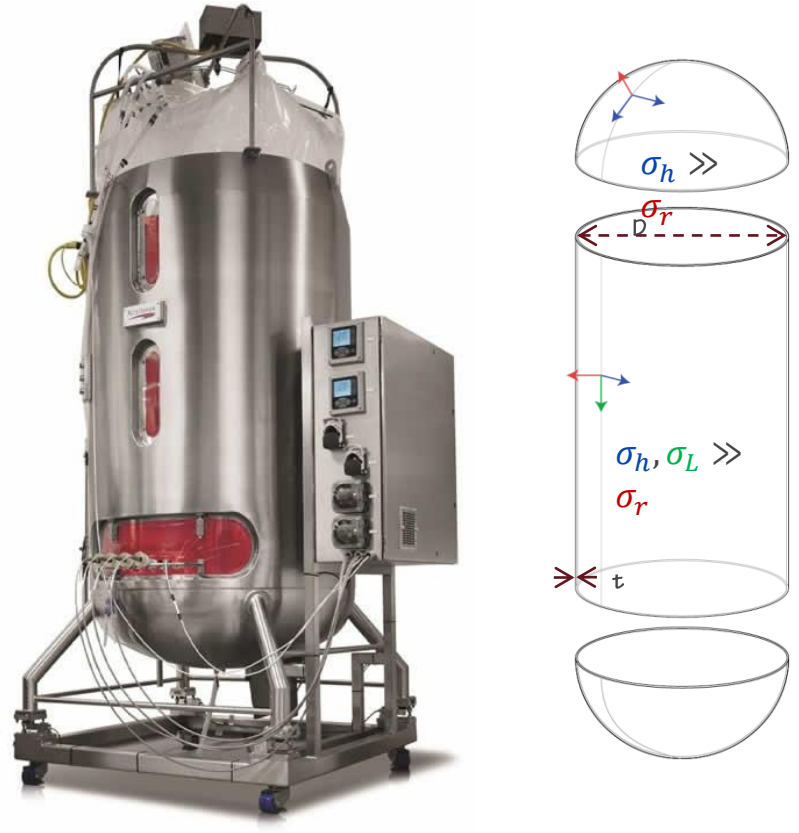
Extreme Environment Mechanicals

Tensile testing



a) Loaded dogbone sample
b) Elastic deformation to a yield point
c) Necking
d) Failure

Modeling high temperature



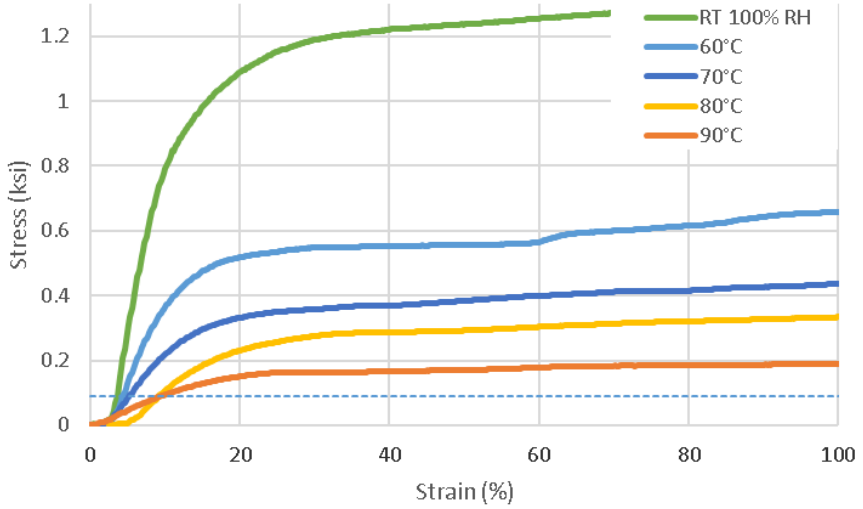
Top Hemisphere is the only unsupported film on the bag

<u>Pasteurization at elevated T Pressure Calculator</u>

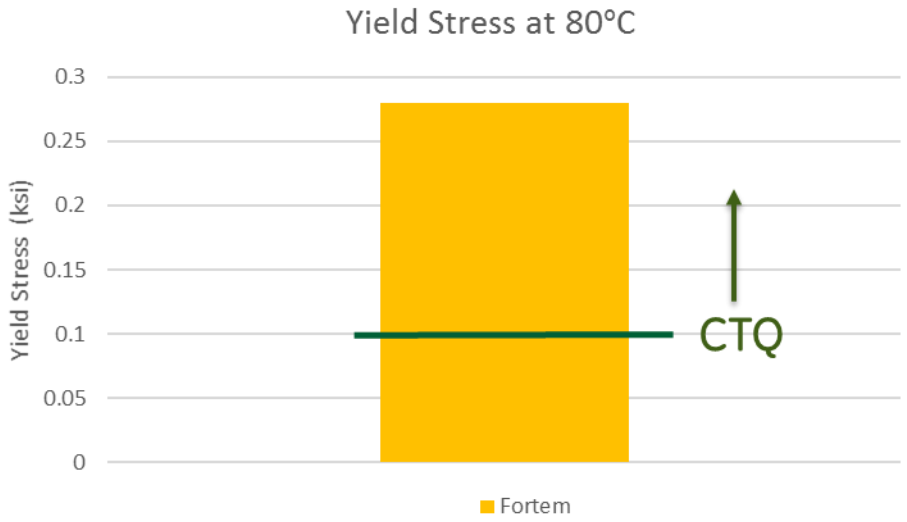
Film Thickness	0.013in
XDR 2000	
Diameter	53.5in
Pressure	0.1psi
sigma(h) hemi (RT)	0.103ksi

High Temperature performance of Fortem™

Tensile Testing at Elevated Temperature



Yield Stress: The amount of force the material experience before it deforms



Temperature-controlled tensile testing enables small scale modeling of film performance in a variety of environments

Key learnings

- Learnings from interaction with every day
- Learned more about project life-time at GE GRC
  - Project lifetime, technical performance measures and readiness, manufacturability
  - Tours of other GRC organizations
  - Different roles
- Knowledge about GE GRC in China
- STEM Outreach – Niskayuna Engineering institute panelist
- Joined Newcomer’s club, Adventurer’s club, Women’s network, and Asian Pacific American Forum
- Outdoor activities and local events (race track, Saratoga spring park, rock climbing gym, bumper ball)

Special thanks:

- Functional Materials Wei Cai
- Dave Moore
- Films Team
- Andrew Burns
- Bill Alberts
- Jack Howson
- Midstream team
- Matt Misner
- Rachel Gettings
- Christine Morton
- Don Buckley
- Mark Walkowicz and Jeremy Trudell
- Paul Smigelski
- Stanlee Buddle
- Dave Demoulpied
- Women's Network
- Materials Group
- Asian Pacific American Forum
- *All other GE employees that have offered support*

Thank you for a fantastic summer!

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