RIT DEPARTMENT OF PACKAGING SCIENCE

Location: RIT - Student Innovation Hall, University Services Center (#87) in Room 1600

- 8:30 - 10:30 a.m. - PMC member Roundtable Discussion
  - General business update.
  - Packaging organization changes - Any changes in your reporting structure?
  - What's keeping you up at night? Current issues affecting your packaging team.

- 10:30 - 11:00 p.m. – Break

Location: RIT - Engineering Building (#82) in Room 1165

- 11:00 a.m. - 12:00 p.m. - *RIT Packaging Science program overview*

Location: RIT - Engineering Building (#82) in Room 1150

- 12:00 - 1:15 p.m. - Lunch and Break at RIT

- 1:15 - 3:15 p.m. - *Tour of RIT Labs and Facilities* including ISTA lab, American Packaging (Flexibles) lab, and Esko design facility

- 3:15 - 3:45 p.m. – Break

Location: RIT – Golisano Institute for Sustainability Auditorium (#81) 1st Floor

- 3:45 - 5:00 p.m. - *OE-A Roadmap for Organic and Printed Electronics in Packaging*, Barbara Fisher, OE-A (Organic and Printed Electronics Association) North America

- 5:30 p.m. – Refreshments and Dinner

  Sticky Lips BBQ - 830 Jefferson Road, Henrietta, NY 14623

Thursday, October 15

Location: Courtyard Brighton

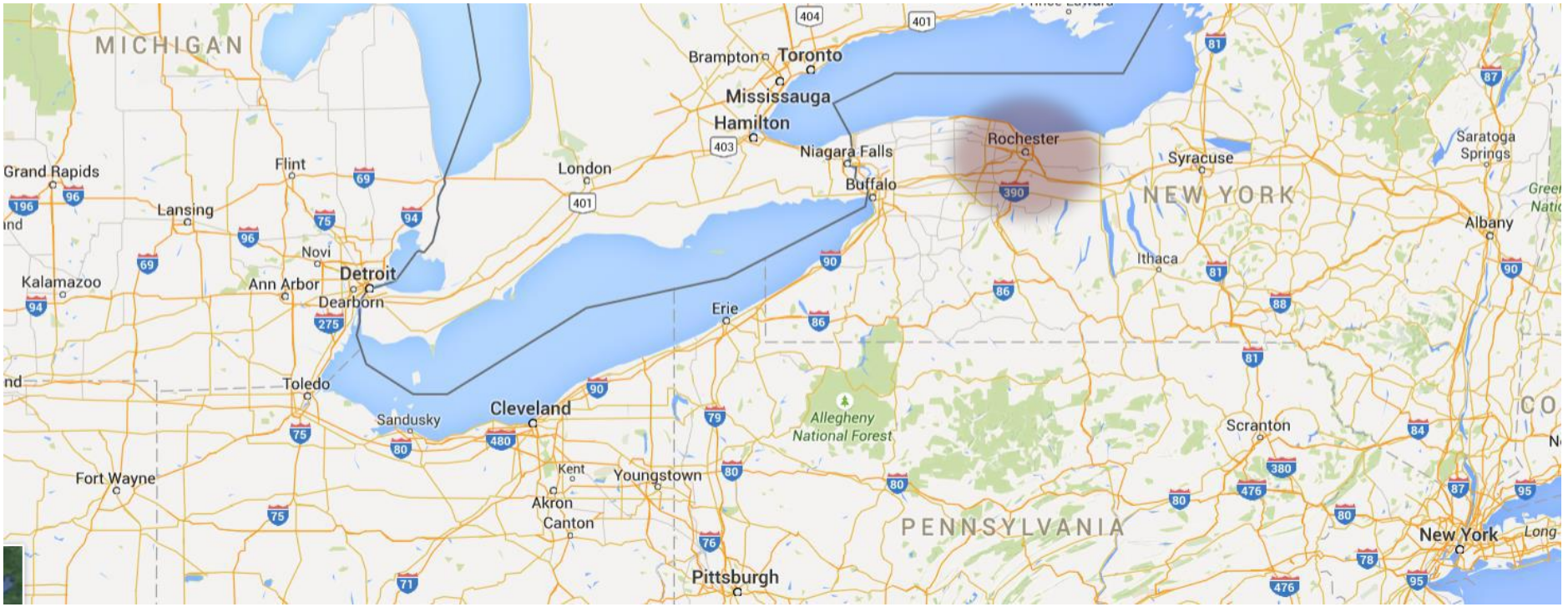
- 7:30 a.m. – Breakfast

Location: Student Innovation Hall, University Services Center (#87) in Room 1600

- 8:30 - 9:30 p.m. - *Digital Printing and Packaging*, Bob Eller, RIT Visiting Professor; former, VP, Exxon Mobil.

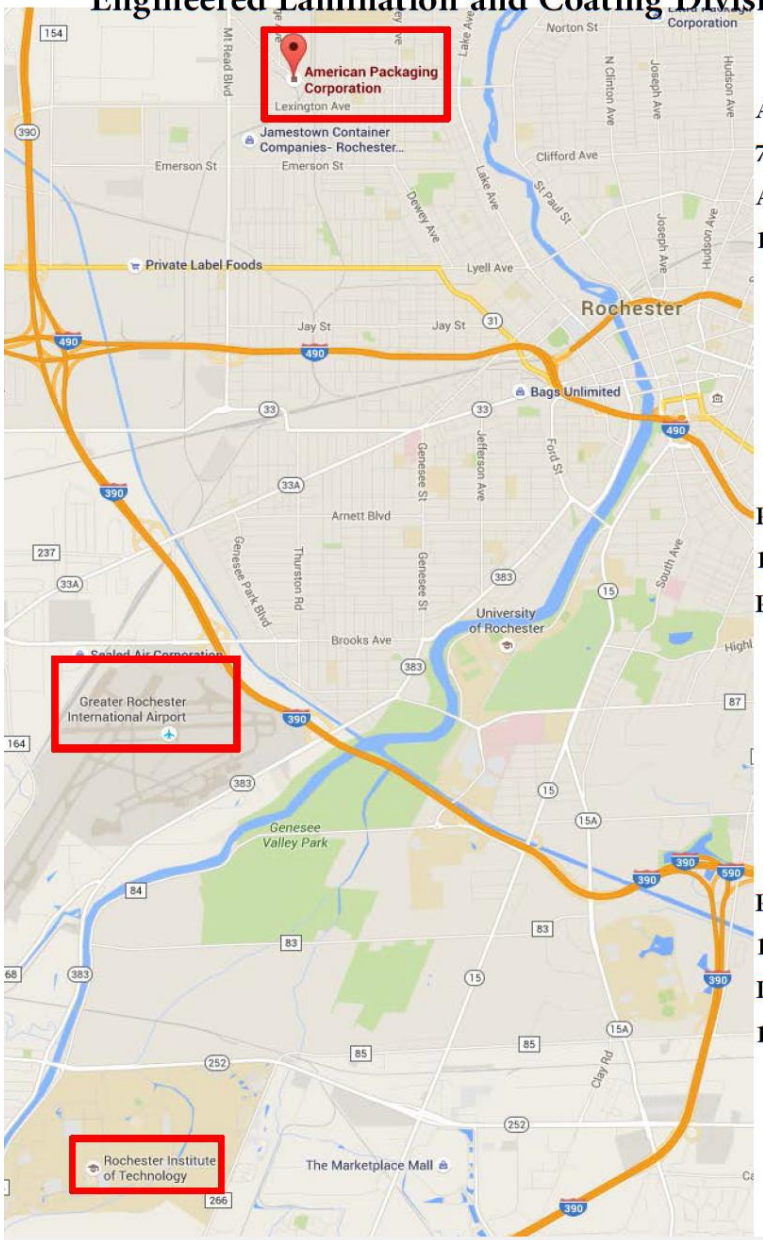
RIT Packaging Update

- RIT, Academic Programs and Placement
- Research and Partners
- Trends and Terminology
- Tours Preview


MICHIGAN
Brampton
Toronto
Mississauga
Hamilton
Niagara Falls
Buffalo
Rochester
Syracuse
Saratoga Springs
NEW YORK
Albany
Ithaca
Grand Rapids
Flint
London
Lansing
Novi
Detroit
Ann Arbor
Dearborn
Kalamazoo
Erie
Toledo
Cleveland
Sandusky
Allegheny National Forest
Scranton
Fort Wayne
Kent
Youngstown
Akron
Canton
PENNSYLVANIA
New York
Pittsburgh

American Packaging Corporation –

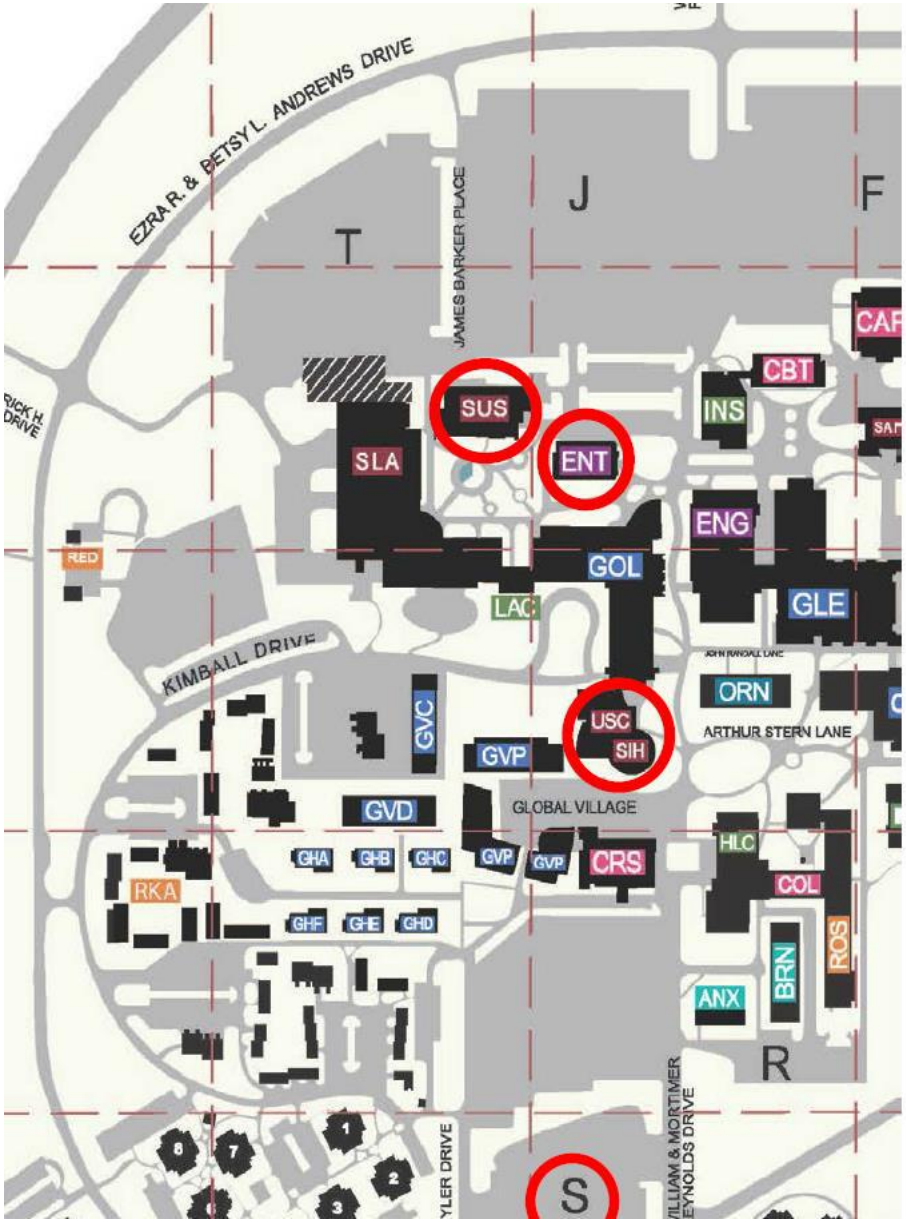
Engineered Lamination and Coating Division



APC Address - 777 Driving Park Ave, Rochester 14613

ROC Airport – 1200 Brooks Ave, Rochester 14624

RIT Address – 1 Lomb Memorial Drive, Rochester 14623



Circled in RED are a few key locations

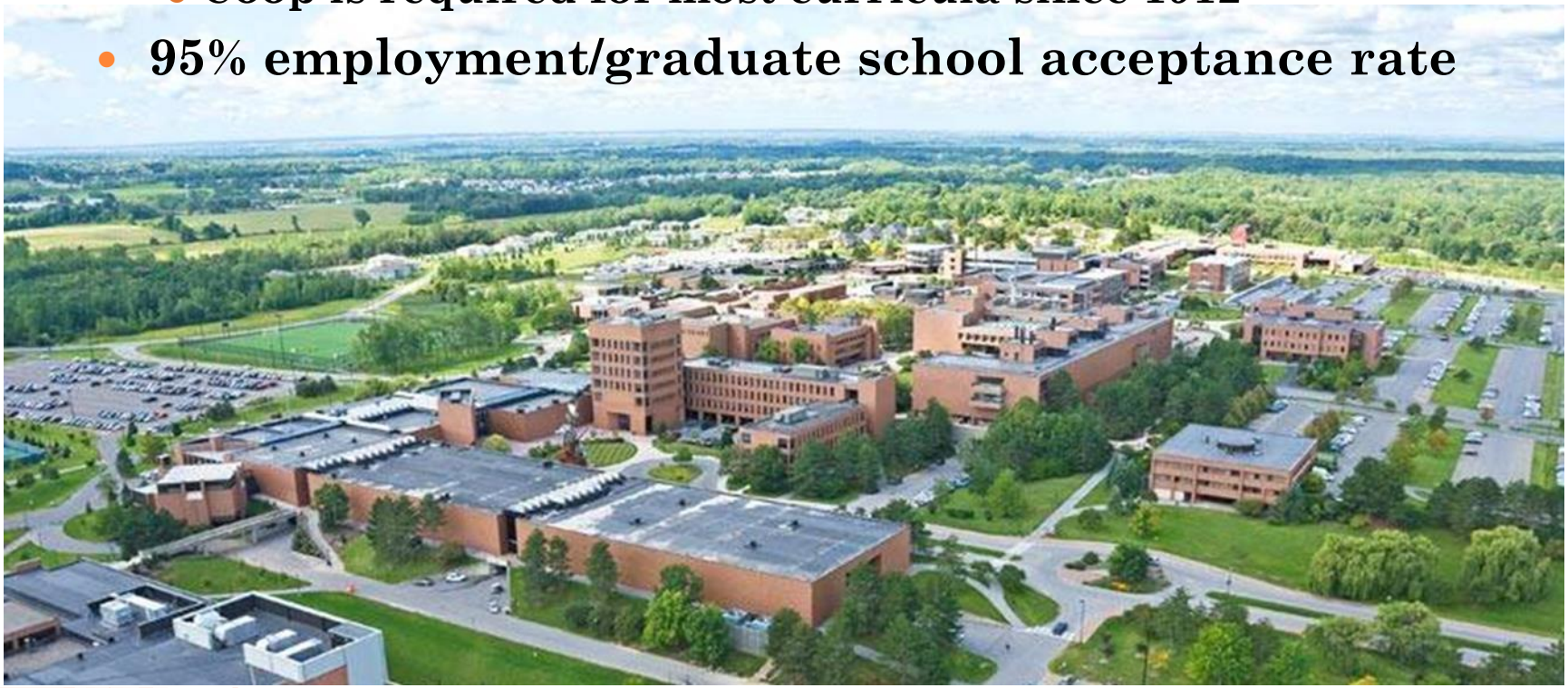
S = S parking lot

USC/SIH = University Services building and Student Innovation Hall,
ENT = Engineering building

SUS = Golisano Institute of Sustainability

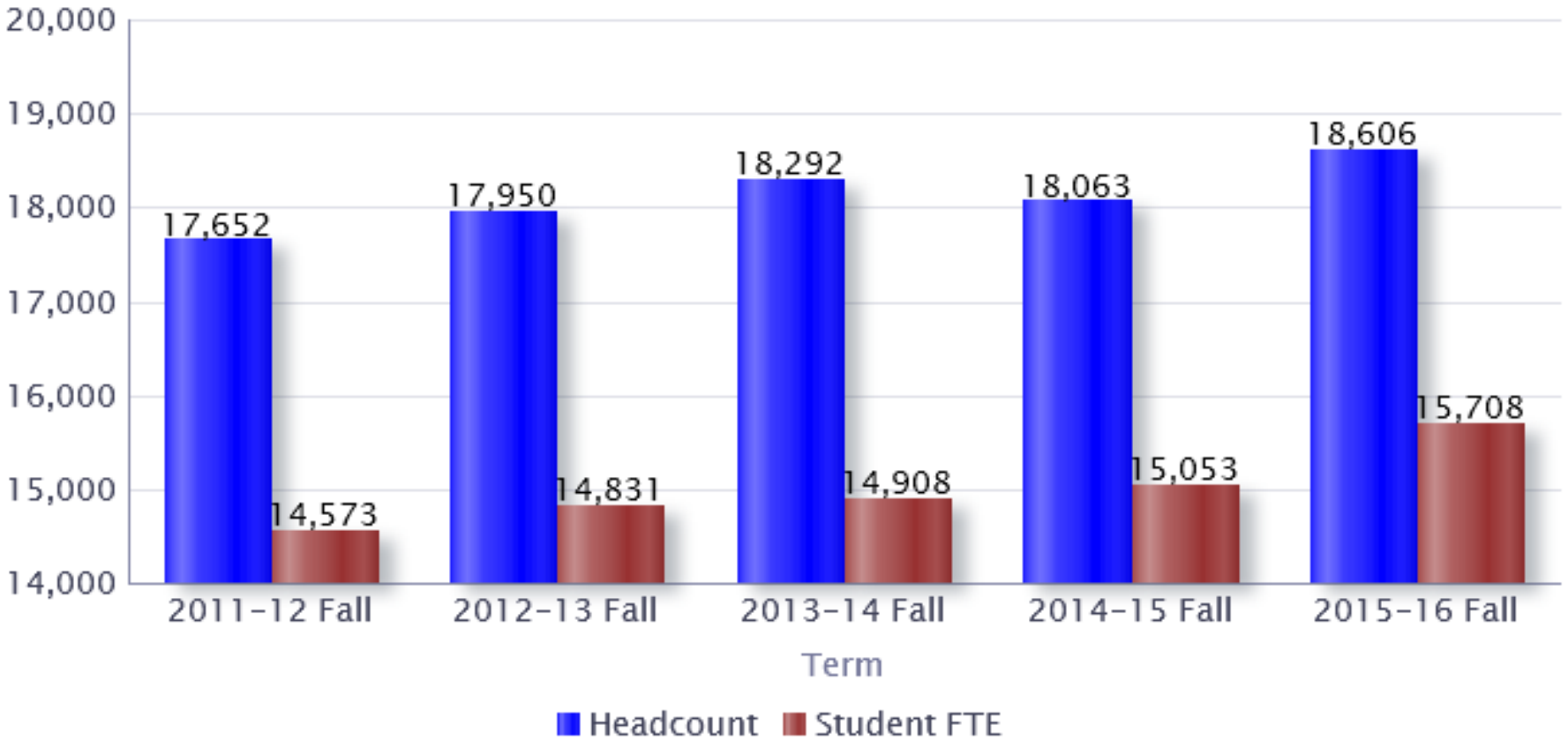
Rochester Institute of Technology

- Founded in 1829 as the Rochester Athenaeum
- 18,606 Students
- 11th Largest Private US University
- #2 in STEM Graduates among private
- Cooperative Education
  - Coop is required for most curricula since 1912
- 95% employment/graduate school acceptance rate



Headcount and Student FTE

Fall 21 Day



Greatness Through Difference:
RIT's 2015-2025 Strategic Plan

During the strategic conversations of the past year, five intersecting spheres of effort have surfaced repeatedly. We have elected to concentrate on these five ***Dimensions***:

1. Career Education and Student Success
2. The Student-Centered Research University
3. Leveraging Difference
4. Affordability, Value, and Return on Investment
5. Organizational Agility

RIT Colleges and Common Packaging Partners

- Applied Science and Technology
  - Packaging Science
  - Engineering Technology
- Engineering
  - Chemical / Mechanical / Industrial & Systems / Sustainable Engineering MS
- Imaging Arts and Science
  - Media Science (Printing) / Graphic Design / Industrial Design / Photo / Film-Video
- Science
  - Microbiology / Material Science / Color Science / Imaging Science
- Health Sciences and Technology
- Computing
  - Network Security / Cyberinfrastructure
- Business
  - Marketing
- Liberal Arts
- National Technical Institute for the Deaf (NTID)
- Golisano Institute for Sustainability

Department of Packaging Science

- Academics
  - BS Packaging Science (200 up 15% since 2012)
  - MS Packaging Science (50 up 45% since 2012)
  - Minor in Packaging Science (50)
  - Minor in Flexible Packaging (new program)
- Research and Outreach
  - Enterprise Center in Packaging
  - American Packaging Corporation Center for Packaging Innovation
  - RIT Center for Sustainable Packaging

AMERICAN PACKAGING CORPORATION

Wegmans

Packaging Science Team

Carlos A. Diaz, *Assistant Professor*

Changfeng Ge, *Professor*

Daniel Goodwin, Emeritus *Professor*

Deanna Jacobs, *Program Chair*

Daniel Johnson, *Department Chair*

Thomas Kausch, *Lecturer*

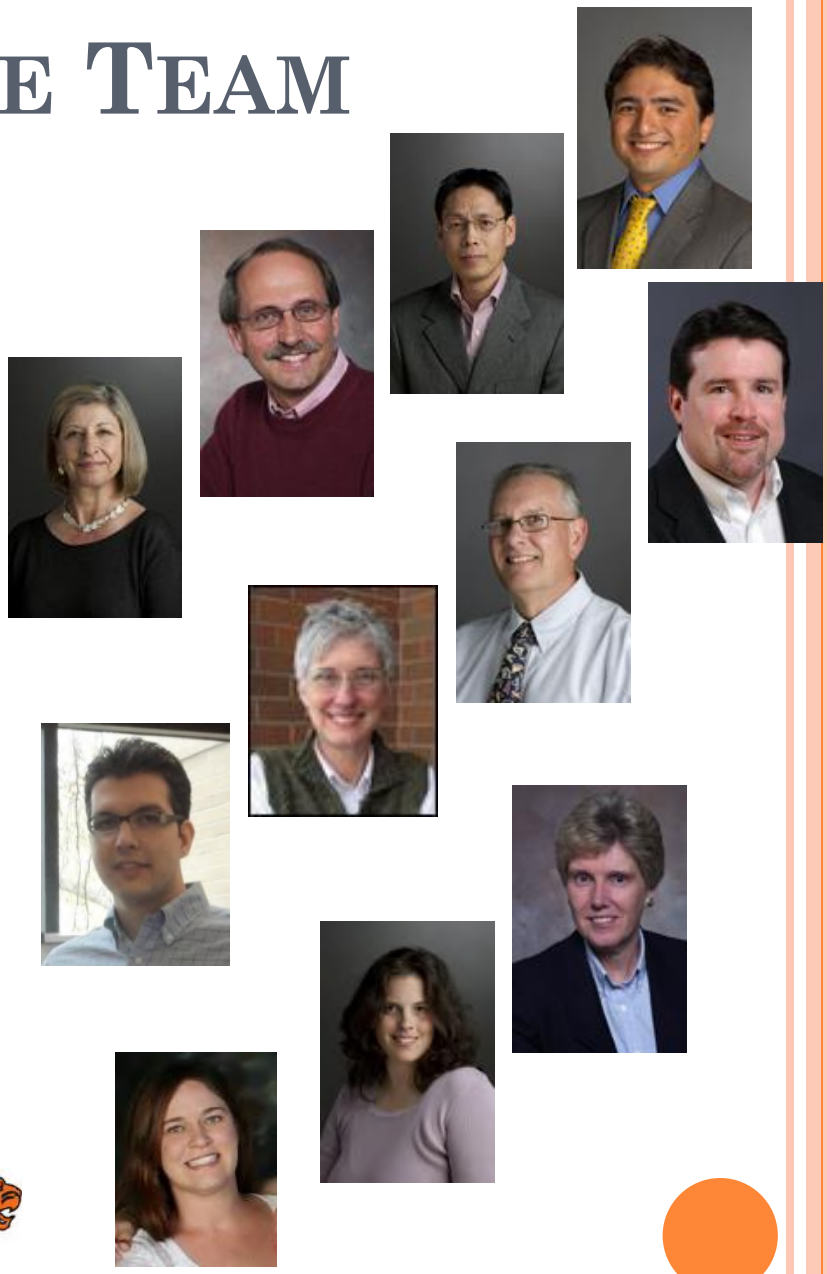
Shauna Newcomb, *Career Services*

Georgios Koutsimanis, *Lecturer*

Karen Proctor, *Professor*

Stefanie Soroka, *Academic Advisor*

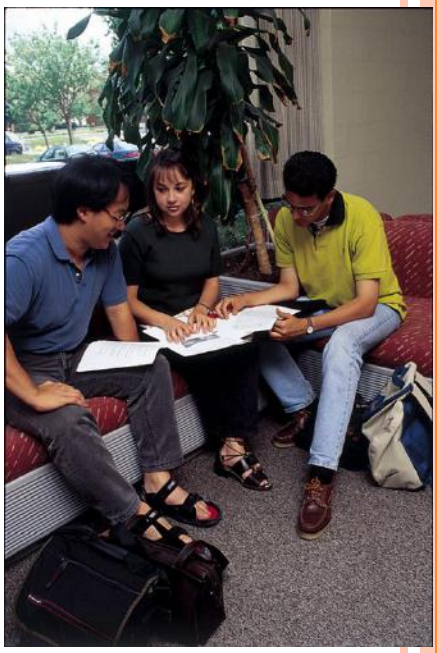
Erin Aaron, *Sr. Staff Assistant*



R·I·T

Academic and Career Support

- Academic Support Center
  - Writing Lab / Math Center / Study Skills
- Bates Study Center
  - Math / Physics / Chemistry / Biology
- Instructors, Program Chairs / Dept Chairs / Office Staff
- Women in Technology
- Coop and Career Services
  - Coop Prep Course and Job Search
- Job Fairs, Specialized Tutoring, Recitation Sections, Lab Teams
- Learning Communities and Colleagues
- Your Advisor



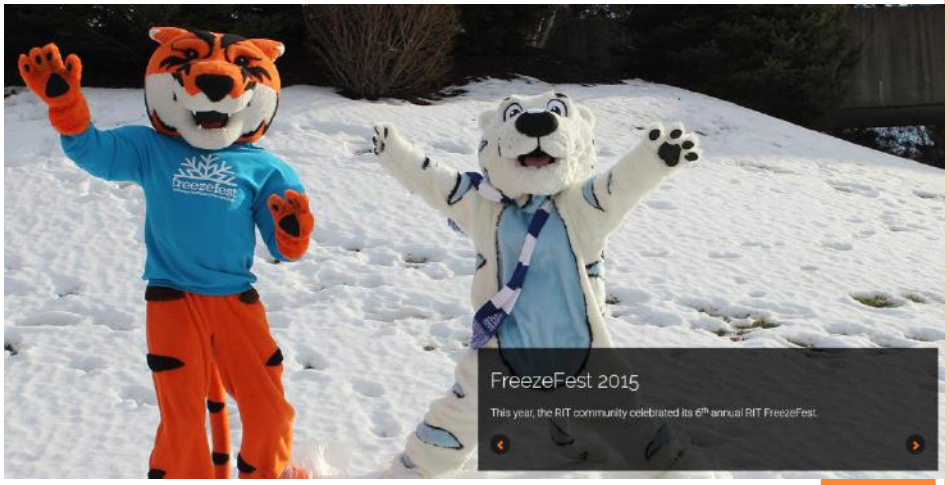
Not Sure Who to Ask / Go to? Ask an advisor or any of our office staff!

Options and Upgrades

- Free and Technical Electives
  - Art and Design
  - Robotics
  - Photography
- Add a Minor
  - Entrepreneurship, International Business
  - Spanish, Marketing
  - Imaging Management Systems
- Build a Double Major
  - Packaging and Economics
- ROTC, Hockey, Lacrosse, Club Ultimate Frisbee
- Custom Schedule
  - Extended Coop, International Coop, Study Abroad
- Accelerated MS Options
  - Packaging
  - MBA
- You do not need to decide on these now,
  - discuss with advisor in first / second year

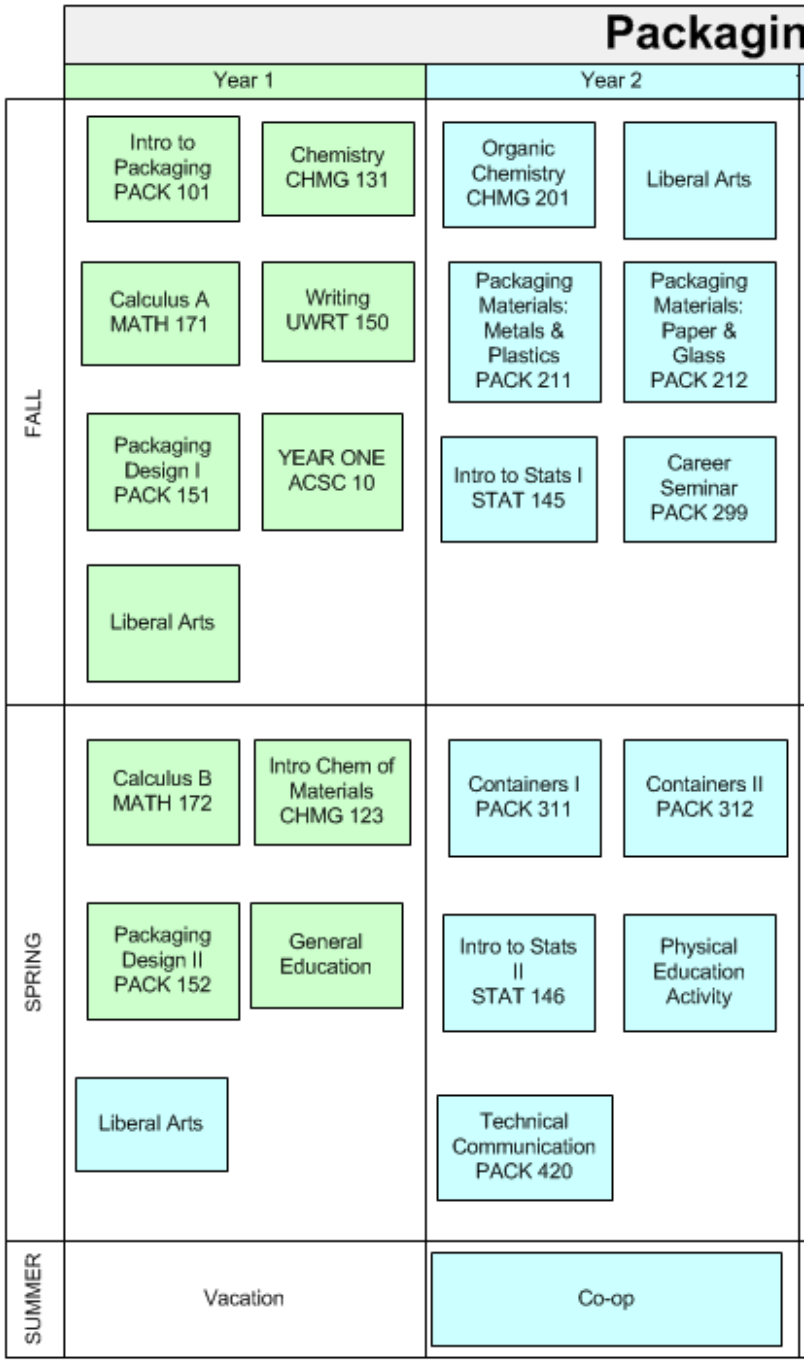
Student Clubs and Activities

- Packaging Students
  - Institute of Packaging Professionals
  - 20-30 Students to PackEXPO (Chicago or Las Vegas)
  - Packaging School Jamboree (Michigan State, Clemson Etc)
  - Plant Tours, Socials, Career Fair Arrangements
- Other Clubs
  - Car Club
  - Geocachers
  - Habitat for Humanity
  - Humans vs Zombies
  - Juggling Club
  - KanJam
  - Kendo Club
  - Motorbike Club
  - Outing Club
  - Ukulele Club
  - Yoga Club
  - Roller Hockey
  - Rugby
  - Sailing Club
  - Tae Kwon Do Club
  - Beard Enthusiasts at RIT Demonstrating Success
  - Rescue Shelter



Packaging Science

	Year 1	Year 2	Year 3	Year 4
FALL	Intro to Packaging PACK 101 Chemistry CHMG 131 Calculus A MATH 171 Writing UWRT 150 Packaging Design I PACK 151 YEAR ONE ACSC 10 Liberal Arts	Organic Chemistry CHMG 201 Liberal Arts Packaging Materials: Metals & Plastics PACK 211 Packaging Materials: Paper & Glass PACK 212 Intro to Stats I STAT 145 Career Seminar PACK 299	Liberal Arts Microbiology MEDG 106 Marketing MKTG 230 Packaging Distribution PACK 421 College Physics I PHYS 111	Printing Elective Food Packaging PACK 470 Technical Elective Liberal Arts Free Elective
SPRING	Calculus B MATH 172 Intro Chem of Materials CHMG 123 Packaging Design II PACK 152 General Education Liberal Arts	Containers I PACK 311 Containers II PACK 312 Intro to Stats II STAT 146 Physical Education Activity Technical Communication PACK 420	Dynamics PACK 422 College Physics II PHYS 112 Packaging Regulations PACK 430 Liberal Arts Technical Elective Physical Education	Packaging for Marketing PACK 481 Liberal Arts Packaging Supply Chain PACK 471 Technical Elective Free Elective
SUMMER	Vacation	Co-op	Co-op	

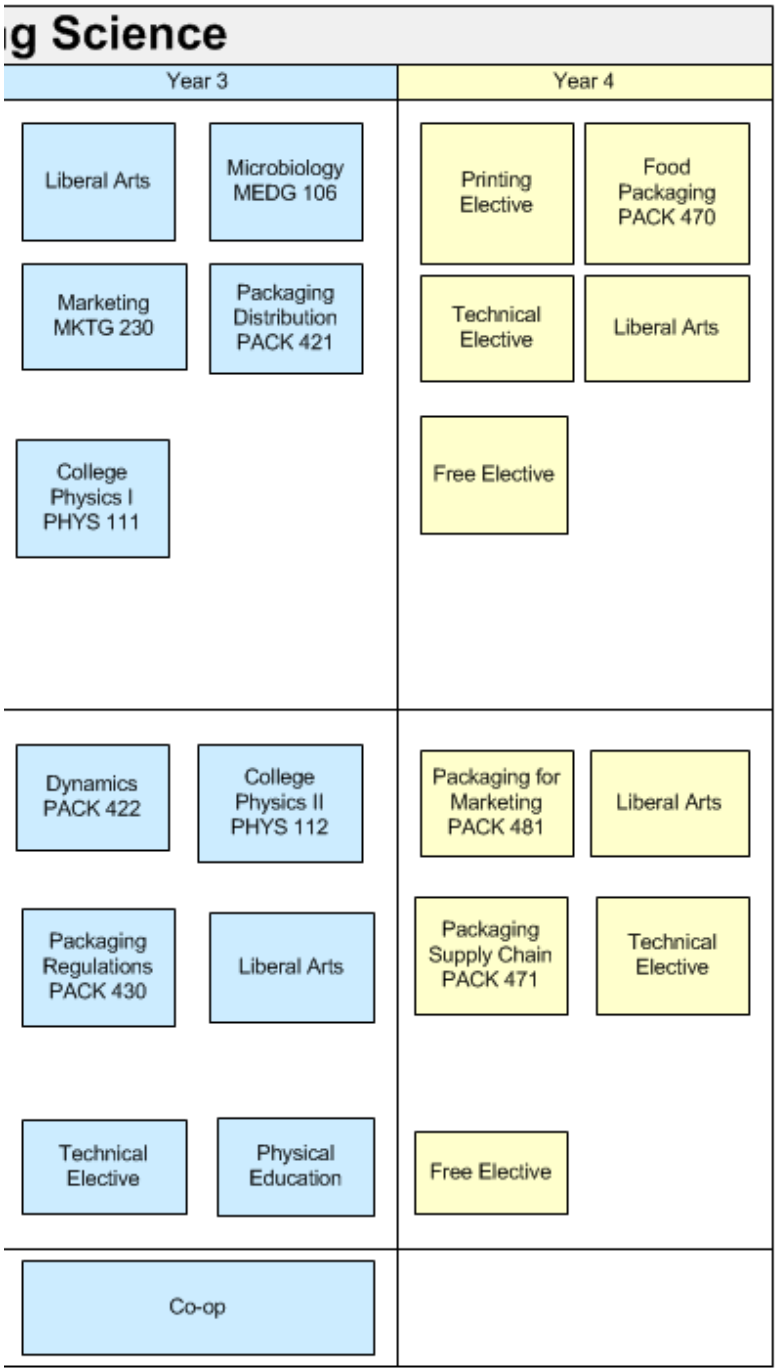


Curricular Notes

- Pack classes in first year
- Two semesters of statistics
- Process control w/green belt option
- Packaging Specific Technical Communication Class
- Career Seminar

Curricular Notes

- Food and Supply Chain Required Classes
- Electives in Pharma/Medical, Equipment, Advanced Development
- Minors:
  - Business Management
  - International Business
  - Languages
- Study Abroad
- Coop Abroad
- Alternate Coop Schedules



Extended Coop

	Year 1	Year 2	Year 3	Year 4	Year 5
FALL	RIT	RIT	RIT	RIT	Coop
WINTER	RIT	RIT	Coop	RIT	RIT
SPRING					
SUMMER	“Vacation”	“Vacation”	Coop	Coop	

Where are PS Graduates Working?

Market / Wage Data

Job Market :

Excellent for co-op, good for full time fresh grads, excellent for 2 - 3+ years experience.

Current Co-op Wage Data:

- Average $19.00/hr
- Low $10.50/hr
- High $30.00/hr

Full Time Wage Data 2014

- Average $58,000
- Low $40,000
- High $72,000

Shauna Newcomb - shnoce@rit.edu
Packaging Coop Coordinator

Co-op and Full time

Full time Positions posted during the academic year*

- **2014-2015** 174 jobs to date
- **2013-2014** 272 jobs
- **2012-2013** 215 jobs
- **2011-2012** 251 jobs

*(does not include alumni jobs from 3rd party recruiters or on campus recruiting)

In Addition (not included in the above numbers)

- 27 Companies attended Packaging Career Fair Feb 4, 2015
  - 27+ co-op jobs +4 full time jobs
- On Campus Recruiting
  - 2014/15 – 21 Interviews (all co-op)
  - 2013/14 – 17 interviews (17 co-op, 1 full time)
  - 2012/13 – 19 interviews (17 co-op, 2 full time)
- Spring and Fall Career Fair- Packaging Companies
  - September 2014 – 1 Company
    - Nice-Pak Products Inc
  - March 2015 - 4 companies
    - Car-Freshner Corporation, Gintzler Graphics, Independent Can Company, J & J

Breakdown by Industry

Packaging Career Fair 2015

- 27 companies / 125 student attended
- 27+ co-op jobs + 4 full time jobs
- Employer Demographics for the fair:

Auto-0	Pharmaceutical- 7	Consumer goods- 10
Cosmetics-1	Packaging related- 4	Food/Beverage- 5

2013-2015 Hiring Company Demographics

93 companies hired co-op:

Auto/Transport/Aero- 10	Pharm/Medical- 21	Consumer goods -19
Cosmetics-4	Packaging related- 20	Food/Beverage- 19

2013-2015 Top Hiring Companies and States

- NY, NJ, PA, MA, CT,RI, CA
- Unilever, Fisher Price, Hasbro, McNeil J & J, Mondelēz, Teleflex

Recent Hiring Companies - Packaging Science

3M
Actavis
American Packaging Corporation
Becton Dickinson
Beiersdorf
Bose Corporation
Boston Scientific
Burt's Bees
Campbell Soup
Church & Dwight Co
CooperVision Inc
Corning Incorporated
Coty Inc
Crayola LLC
Diageo
Eastman Kodak Co
EISAI Inc
Elizabeth Arden
Empire Box
Energizer Personal Care
Equity Packaging
Fisher-Price
GlaxoSmithkline
Godiva Chocolatier
Green Mountain Coffee Roasters
H.J. Heinz Company
Hartz
Hasbro
High Liner Foods
Honda
Johnson & Johnson
Kellogg Company
Kraft
L'Oreal USA
Lactalis America Group Inc
LiDestri Foods Inc
LifeCell Corporation
Lindt & Sprungli
Mars
Mattel Inc
McCormick & Company
McNeil Consumer Healthcare
MeadWestvaco
Medtronic Interventional Vascular
Merck & Co
Mondelez
MSA
Multisorb Technologies
Nice-Pak Products
NOVA Chemicals
Ocean Spray
Ortho Clinical Diagnostics
OtterBox
Packaging Corporation of America
Packaging Technologies & Inspection
Pfizer Consumer Healthcare
Procter & Gamble
Rand Whitney
Rich Products
Rock-Tenn Company
SC Johnson & Son Inc
Sealed Air
Shire Pharmaceuticals
SpaceX
Teleflex
The Hershey Company
The Sun Products
Thermo Fisher Scientific
Toyota Motor Engineering & Manufacturing
Unilever
United Pet Group - Aquatic Division
Unither Pharmaceuticals
Wegmans
West Pharmaceutical
Wrigley
Wyeth Consumer Healthcare
Xerox
Zimmer
Zotos International

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AMERICAN PACKAGING CORPORATION

Wegmans

Research Sponsors / Partners

FLX Food

Enterprise Center: 150+ Projects Per year

Constellation	Dole Foods	Bureau Veritas
Corning	Chobani	Green Mountain
7th Generation	Coopervision	DuPont
GE	Borg Warner	PCA

State/Federal

NSF
NASA
NY Pollution Prev. Institute

System View of Sustainability in Packaging

Optimize Material Source

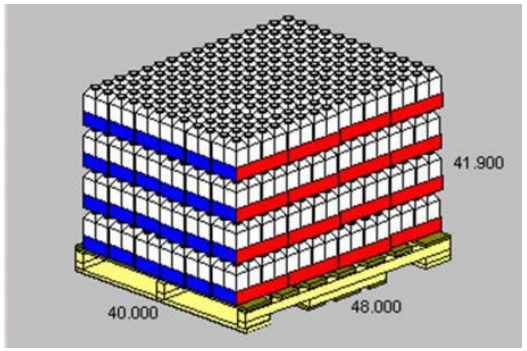
Optimize Material Disposition

Minimize Distribution Energy

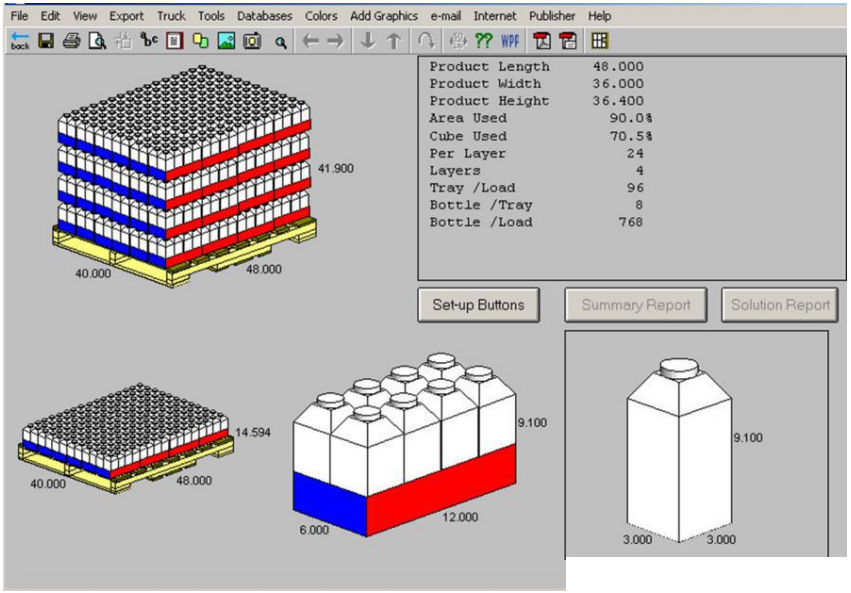
Minimize Damage Loss and Waste

Maximize Utility and Convenience

Product/Customer/Market



Design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Product Length 48.000
Product Width 36.000
Product Height 36.400
Area Used 90.0%
Cube Used 70.5%
Per Layer 24
Layers 4
Tray /Load 96
Bottle /Tray 8
Bottle /Load 768
41.900
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Set-up Buttons
Summary Report
Solution Report
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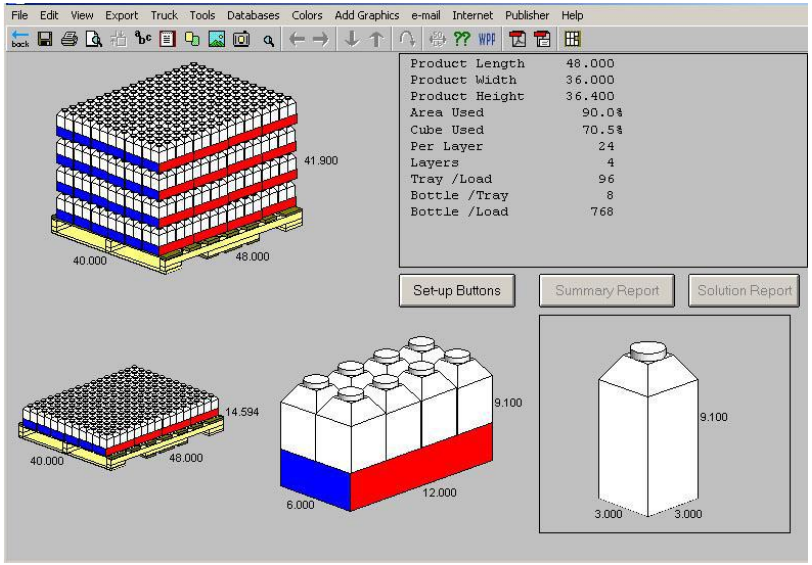
Wegmans
MEMPHIS
BBQ
SAUCE
BBQ
SUMMER SIZZLIN'
VARIETY PACK
KANSAS CITY
JERK
BROWN SUGAR
ASIAN
MEMPHIS SAUCE


32
Wegmans
ADVANCE
2x laundry detergent
FREE
3.19
$4.99


42
Wegmans
ADVANCE
Dye & Perfume Free
2x
Mountain Air
Original
Ocean Breeze

Design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Product Width 36.000
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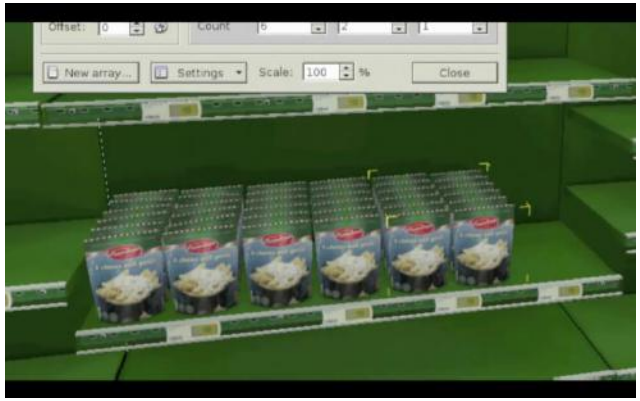
Kongsberg XP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Scale: 100 %
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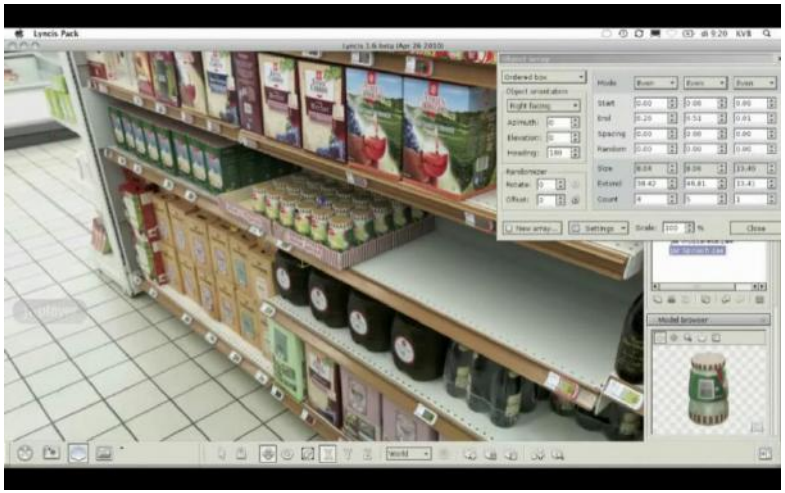
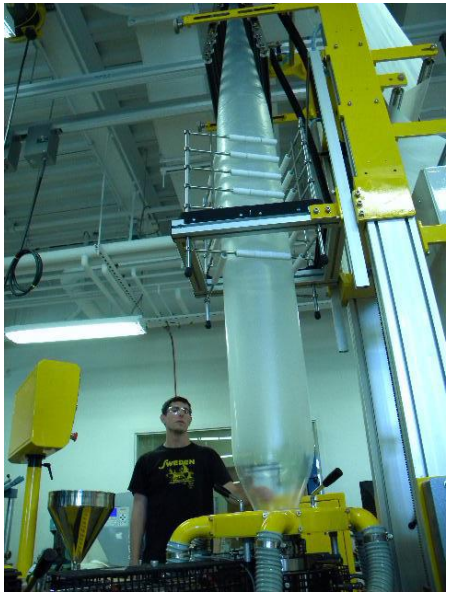
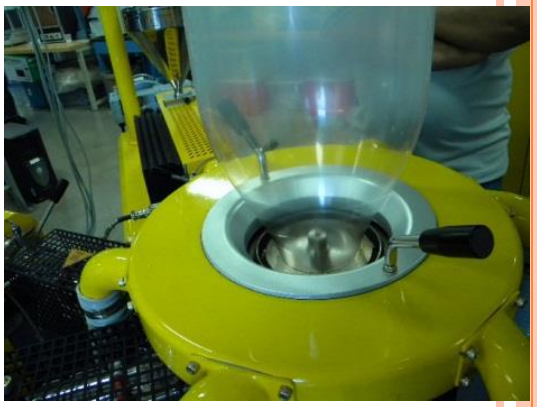



CHIX
CRISPS
Exotic Spices & Lime
STUDIO


Nancy Yang
PACKAGING FOR END USE
R·I·T
INSPIRATION
Brand Identification
Value Added
Premiumization
Shelf Visibility
Easy Stacking Feature
Cover and bottom of the cup provides a stable stacking
Wegmans
Organic
Super Yogurt
Cover
Material. PP
Color. Transparent
Feature. Easy stacking
Lid
Material. Al Foil with emboss texture
Cup
Material. PP
Feature. Easy stacking
End of Use
Blue Box
Decoration
Shrink Sleeve
Color. Opaque Black with Matte Finish
CURRENT FAMILY PACK
NEW FAMILY PACK
NEW SHIPPER
LOWFAT YOGURT
Overall Dimension (in):
11.8 * 8.9 *10.08 (New Design)
13.0 * 10.0 * 11.80 (Current)
18.2% more boxes per pallet
11.7% less package product ratio
19.7% less materials
100.3% more yogurts per pallet
25.6% less package product Ratio

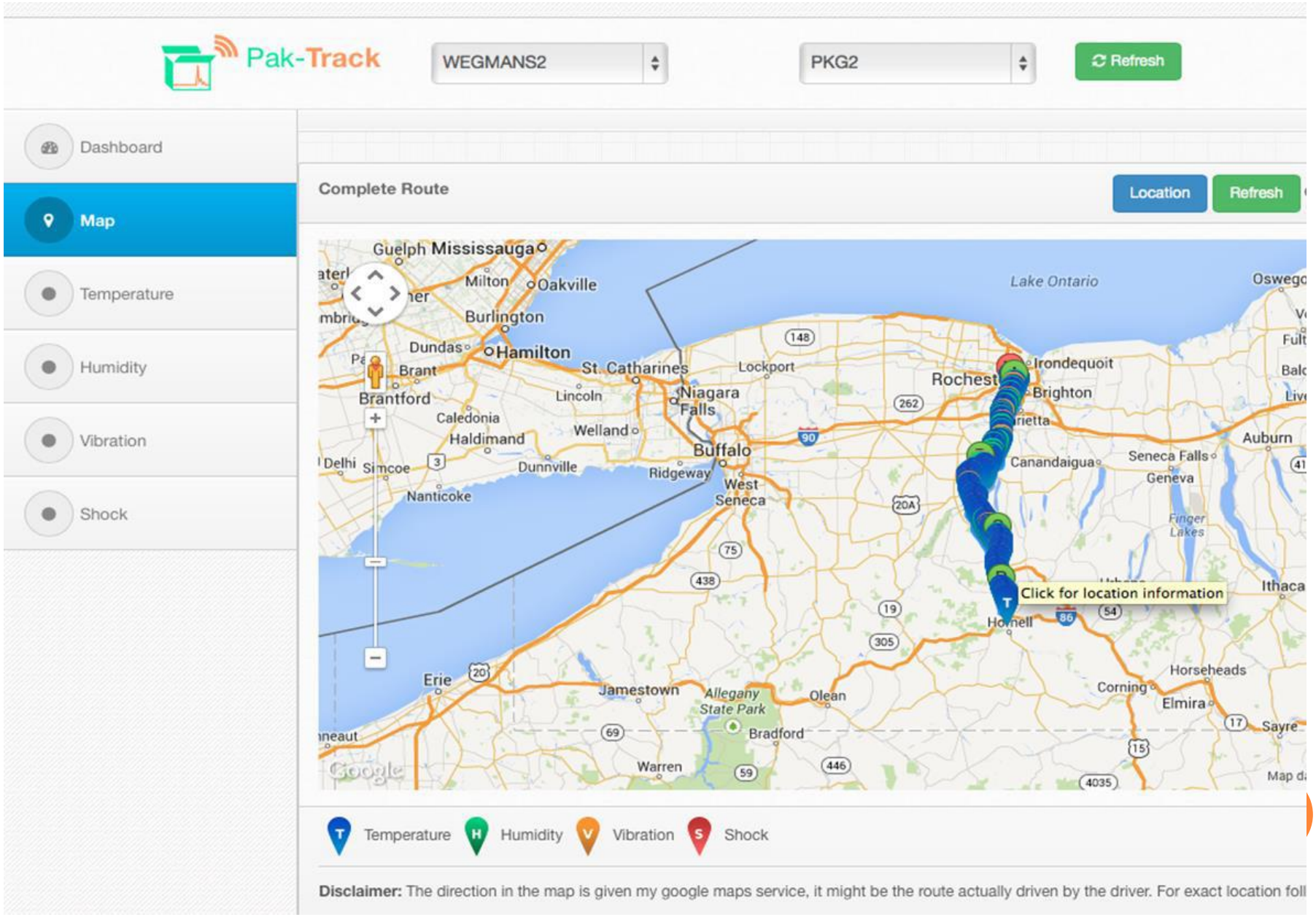
Optimize Materials
Source / Service / Disposition





Minimize Loss/Damage

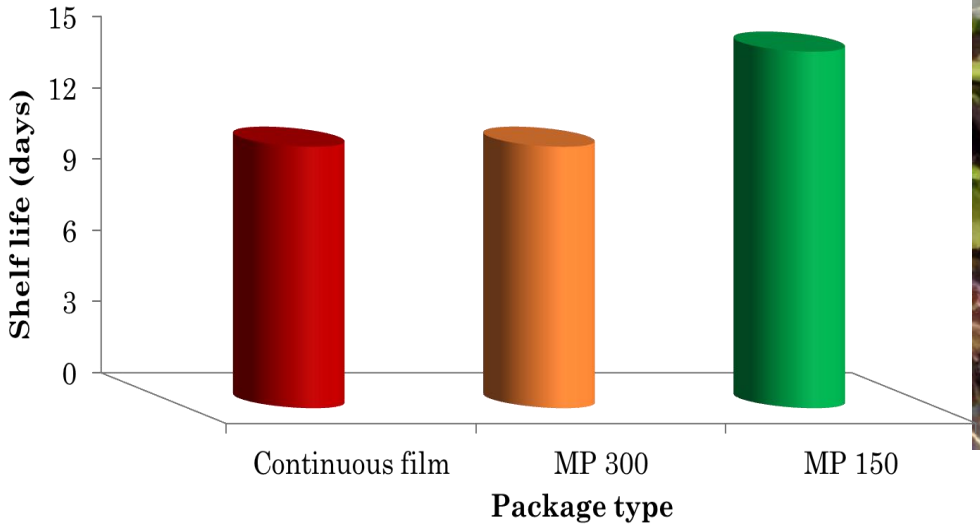
Minimize Loss-Damage-Waste



Fresh produce packaging

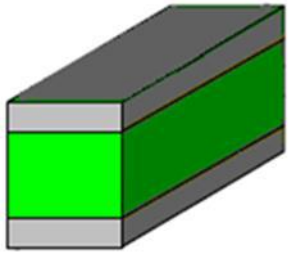
- Exploring Growth Areas and Innovation

- Sample Project
- Wegmans Organic Farm - Organic spring mix
- LDPE 1.1mil (continuous & micro-perforated)
- 150 or 300 micro-perforations (MP 150 and 300)
- Storage at 40 °F



PLANTIC

- Plant Based Material



Proprietary Plantic eco Plastic™
PET

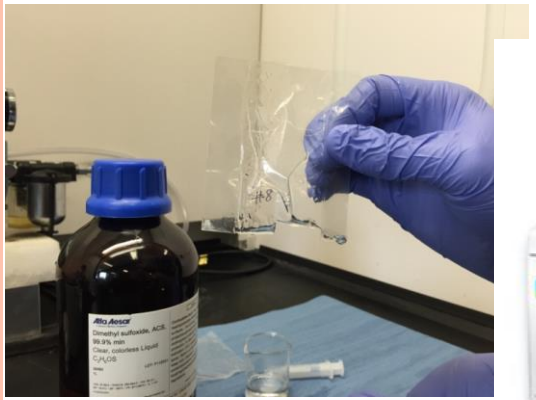
Adding Value Across Supply Chain

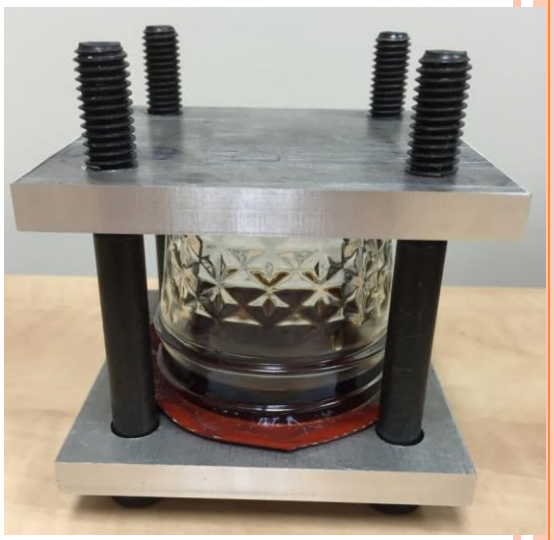
High Pressure Processing

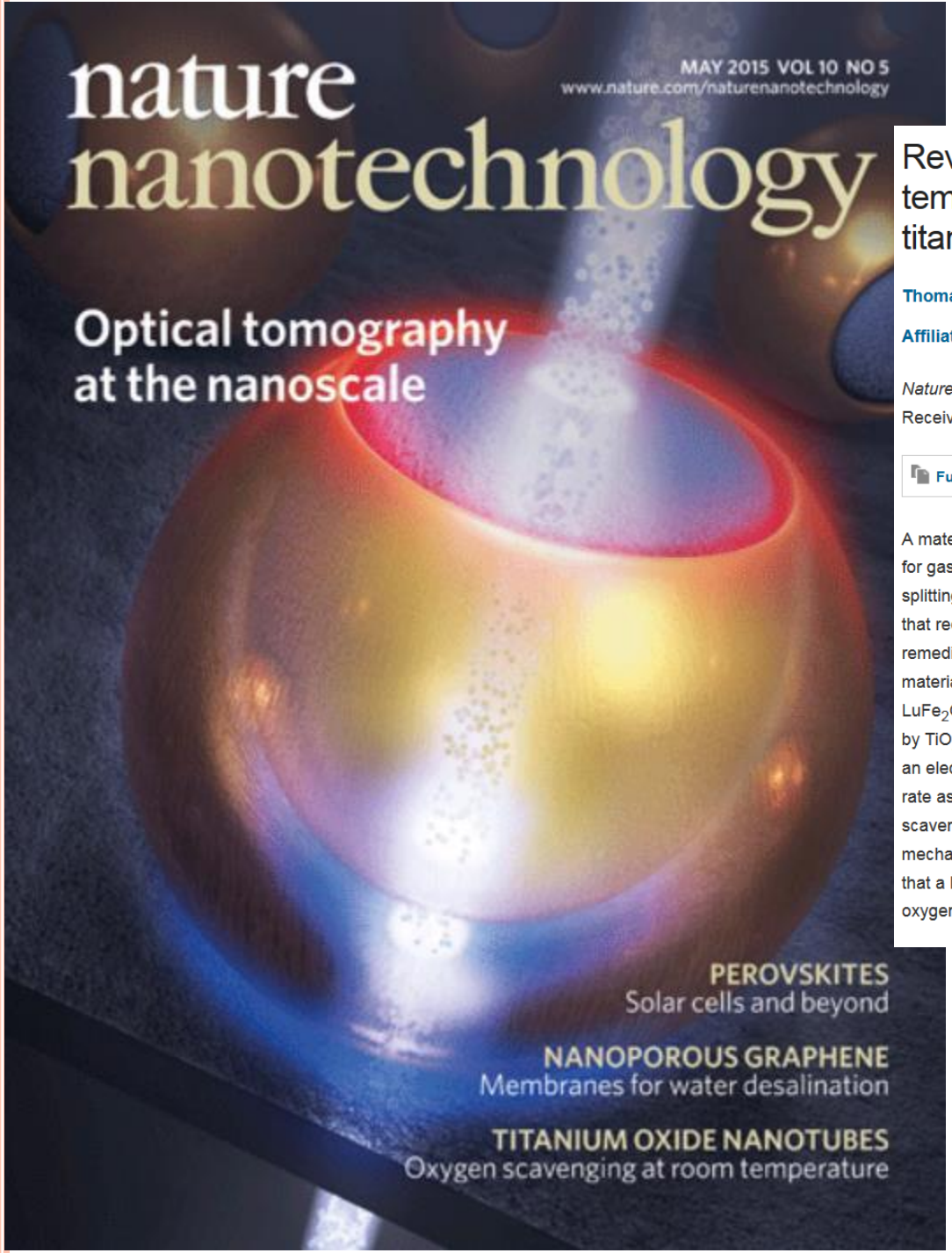
- Existing Packaging is often acceptable, but…
  - HPP exposes processing weaknesses
  - Invites innovation in stagnant categories

Migration studies

- Material/Process Innovations Drive Need
  - Packaging Material Migration into Product
  - Product Migration into Packaging







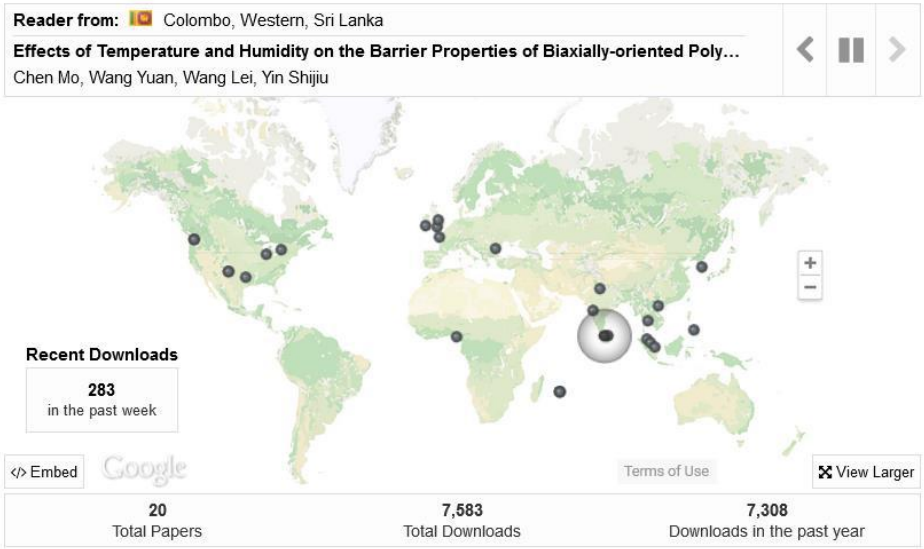
Reversible oxygen scavenging at room temperature using electrochemically reduced titanium oxide nanotubes

Thomas Close, Gaurav Tulsyan, Carlos A. Diaz, Steven J. Weinstein & Christiaan Richter

Affiliations | Contributions | Corresponding author

Nature Nanotechnology **10**, 418–422 (2015) | doi:10.1038/nnano.2015.51
Received 19 August 2014 | Accepted 19 February 2015 | Published online 06 April 2015

A material capable of rapid, reversible molecular oxygen uptake at room temperature is desirable for gas separation and sensing[1, 2], for technologies that require oxygen storage and oxygen splitting such as fuel cells (solid-oxide fuel cells in particular)[3, 4, 5, 6] and for catalytic applications that require reduced oxygen species (such as removal of organic pollutants in water and oil-spill remediation). To date, however, the lowest reported temperature for a reversible oxygen uptake material is in the range of 200–300 °C, achieved in the transition metal oxides $SrCoO_x$ (ref. 1) and $LuFe_2O_{4+x}$ (ref. 2) via thermal cycling. Here, we report rapid and reversible oxygen scavenging by TiO_{2-x} nanotubes at room temperature. The uptake and release of oxygen is accomplished by an electrochemical rather than a standard thermal approach[1, 2, 7]. We measure an oxygen uptake rate as high as 14 mmol O_2 g^{-1} min^{-1}, ~2,400 times greater than commercial, irreversible oxygen scavengers. Such a fast oxygen uptake at a remarkably low temperature suggests a non-typical mechanistic pathway for the re-oxidation of TiO_{2-x}. Modelling the diffusion of oxygen, we show that a likely pathway involves 'exceptionally mobile' interstitial oxygen[8, 9, 10] produced by the oxygen adsorption and decomposition dynamics, recently observed on the surface of anatase[6].



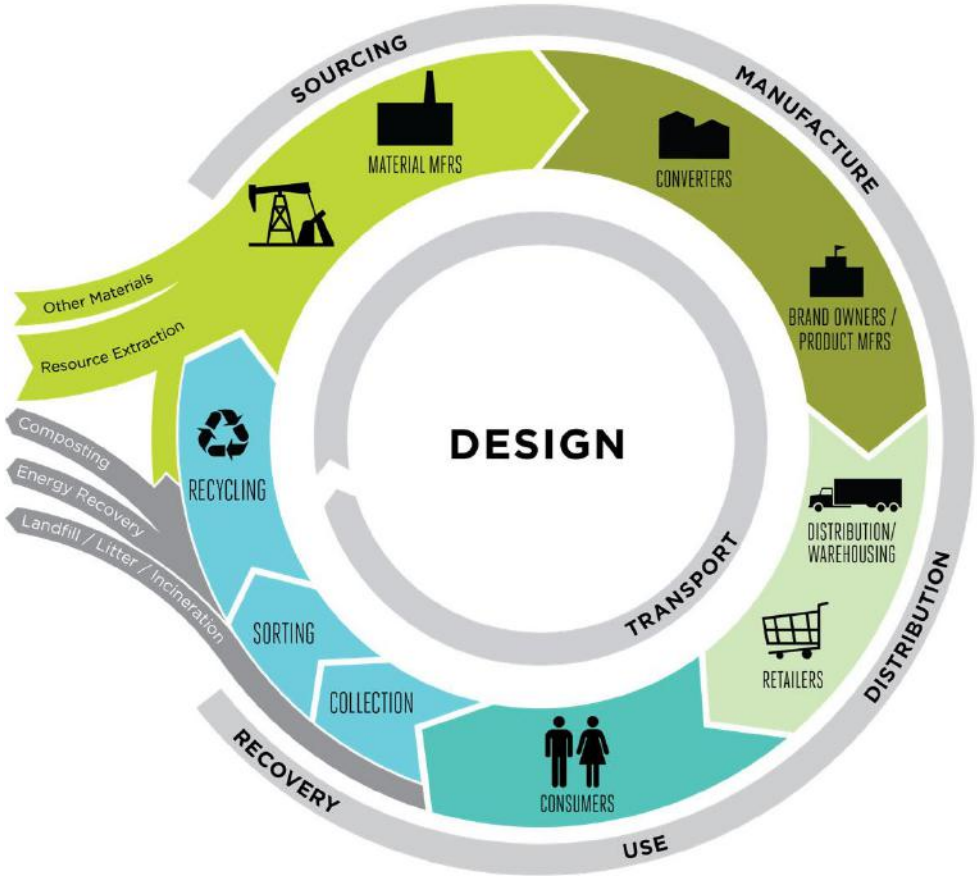
RIT Published Journal

- Rochester Institute of Technology
- University of Florida
- California Polytechnic State University
- Kasetart University (Thailand)
- Michigan State University
- Nestle
- Purdue University
- San Jose State University
- Packaging Forensic Associates
- Jiangnan University, China
- Kobe University, Japan
- Clemson University
- The University Montpellier II, France
- Lund University, Sweden
- International Safe Transit Association (ISTA)

Trends / Interesting Topics

System View of Sustainability in Packaging

Circular Economy + Sustainability



Definition and Graphic from
The Sustainable Packaging Coalition
a Project of GreenBlue

Sustainable packaging

- Is beneficial, safe & healthy for individuals and communities throughout its life cycle
- Meets market criteria for performance and cost
- Is sourced, manufactured, transported, and recycled using renewable energy
- Optimizes the use of renewable or recycled source materials
- Is manufactured using clean production technologies and best practices
- Is made from materials healthy throughout the life cycle
- Is physically designed to optimize materials and energy
- Is effectively recovered and utilized in biological and/or industrial closed loop cycles

http://www.sustainablepackaging.org

Mfg Features

Distribution Features

Purchase Features

User Features

$$\text{Value} = \frac{\text{Positive Aspects (features/benefits)}}{\text{Sum of the Negative Aspects (cost)}}$$

Positive Power of Packaging

DIGIMARC

Packaging

Significantly accelerate checkout scanning speed. Provide unprecedented customer mobile engagement. Imperceptible to humans, Digimarc-enabled packaging speeds the checkout process for clerks and customers and drives customer engagement at every touchpoint along the shopper's journey.

ALL MADE POSSIBLE WITH DIGIMARC® BARCODE

Digimarc® Barcodes significantly reduce the time your shoppers spend in checkout lanes. How? By eliminating the need to hunt for the barcode before scanning each item. We imperceptibly embed the product's Global Trade Item Number (GTIN) data across every surface, making the entire package scannable.

What Packaging can I Digimarc-enable?

How2Recycle™ 2014 Annual Report now available →

The Labels

*Not recycled in all communities

WIDELY RECYCLED

At least 60% of the U.S. population can recycle this package type at curbside or municipal drop-off locations.

LIMITED RECYCLING

Between 20 - 60% of the U.S. population can recycle this package type at curbside or municipal drop-off locations. Check your local program.

NOT YET RECYCLED

Less than 20% of the U.S. population can recycle this package type OR includes a known contaminant to common recycling systems.

STORE DROP-OFF

Polyethylene bags and films are widely recycled at store collection points, including grocery and other retail stores. Check for participating locations.

Multiple Distribution Chains to Survive

- Traditional Retail Product Flow
  - Manufacturing to Warehouse to Distribution Center
  - Case Quantities Sent to Store via Mixed Pallet Shipments
- Warehouse Club Flow
  - Manufacturing to Warehouse to Distribution Center
  - Full Pallet Quantities Sent to Store
  - Custom Bulk-Pack May be Required
- Online (Amazon/Jet Style) Flow
  - Manufacturing to Warehouse to Distribution Center/Fulfillment Center
  - Ships to customer via Small Parcel
- Online (Walmart Style) Flow
  - Regional store acts as fulfillment center and ships via Small Parcel

ISTA AND ASTM

3A

Equipment Required Atmospheric Conditioning

EQUIPMENT REQUIRED FOR PROCEDURE 3A

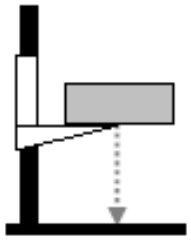
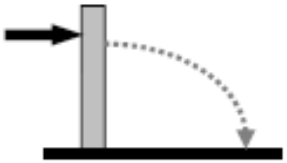
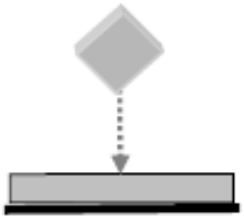
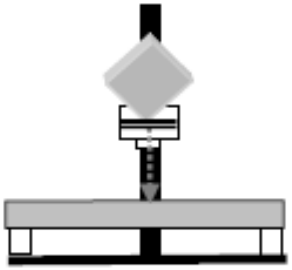
Atmospheric Conditioning:

- Humidity recorder complying with the apparatus section of ISO 2233 or ASTM D 4332.
- Temperature recorder complying with the apparatus section of ISO 2233 or ASTM D 4332.

Optional Atmospheric Conditioning

- Chamber and Control apparatus complying with the apparatus section of ISO 2233 or ASTM D 4332.

Equipment Required Shock

	All Protocols	Flat and Elongated	Flat	Elongated
Type of Shock Test	Drop Test	Rotational Edge Drop Test Full Rotational Test	Hazard Impact Test	Bridge Impact Test
Type of Equipment	Free-fall drop tester 	1) Support Block  2) 	Hand Drop with Hazard Box 	Free-fall Drop Tester with Hazard Box 
In compliance with the apparatus section of...	ISO 2248 **or** ASTM D 5276	ISO 2876 **or** ASTM D 6179		ASTM D 5265 with the exception of the Hazard Box (Impactor). See below

Observed Trends in Packaging

- Premiumization & Convenience
  - w/ Sustainability Story
- Food Waste
  - Key Sustainability Issue
- Continued Growth in Flexibles
  - Emerging Markets and Line Expansions
- Large CPG's
  - Looking for simple, local grown look and feel for national and international products
- Safety/Purity (natural-organic in particular)
- Acceptance of more Innovation
  - Features – Portioning, Reseal
  - Feel Good Disposal

Tour

- Materials and Prototyping
  - Esko Design Software
  - Karen Proctor – Pkg Development Projects
- Printing Applications Lab – Digital Applications
- ISTA Certified Dynamics Lab
- American Packaging Center for Packaging Innovation

- Big School / Small Department
- Blends Creative, Scientific, Business and High Technology – Variety of Career Directions
- Outstanding Placement, Networking, Corporate and Alumni Support