Active and intelligent packaging

Prof. Dr. ir. Peter Ragaert

Technological advisor - Pack4Food

Docent food packaging technology - Ghent University

21st of November 2013

Ons voedsel: Veilig verpakt? – AOAC-LL Symposium – Breda

UNIVERSITEIT GENT

Pack4Food

Vlaams Innovatienetwerk met steun van IWT

Pack4Food

INDUSTRY

49 members

12 RESEARCH INSTITUTES & NETWORKORGANISATIONS

Filling systems

Food products

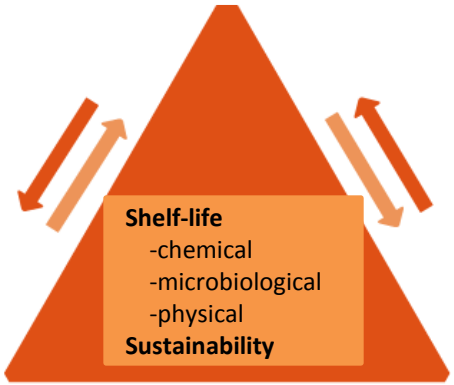
Gasses

Packaging materials

Resins

Distribution

Food products
-composition
-pH
-aw



Filling System
-standard
-clean
-ultraclean
-Hot fill
-Aseptic
-In packaging
-MAP

Packaging material
-barrier
-active
-passive
-closure systems
-migration

© 2013 – Peter Ragaert

Activities Pack4Food

Advices

Research projects

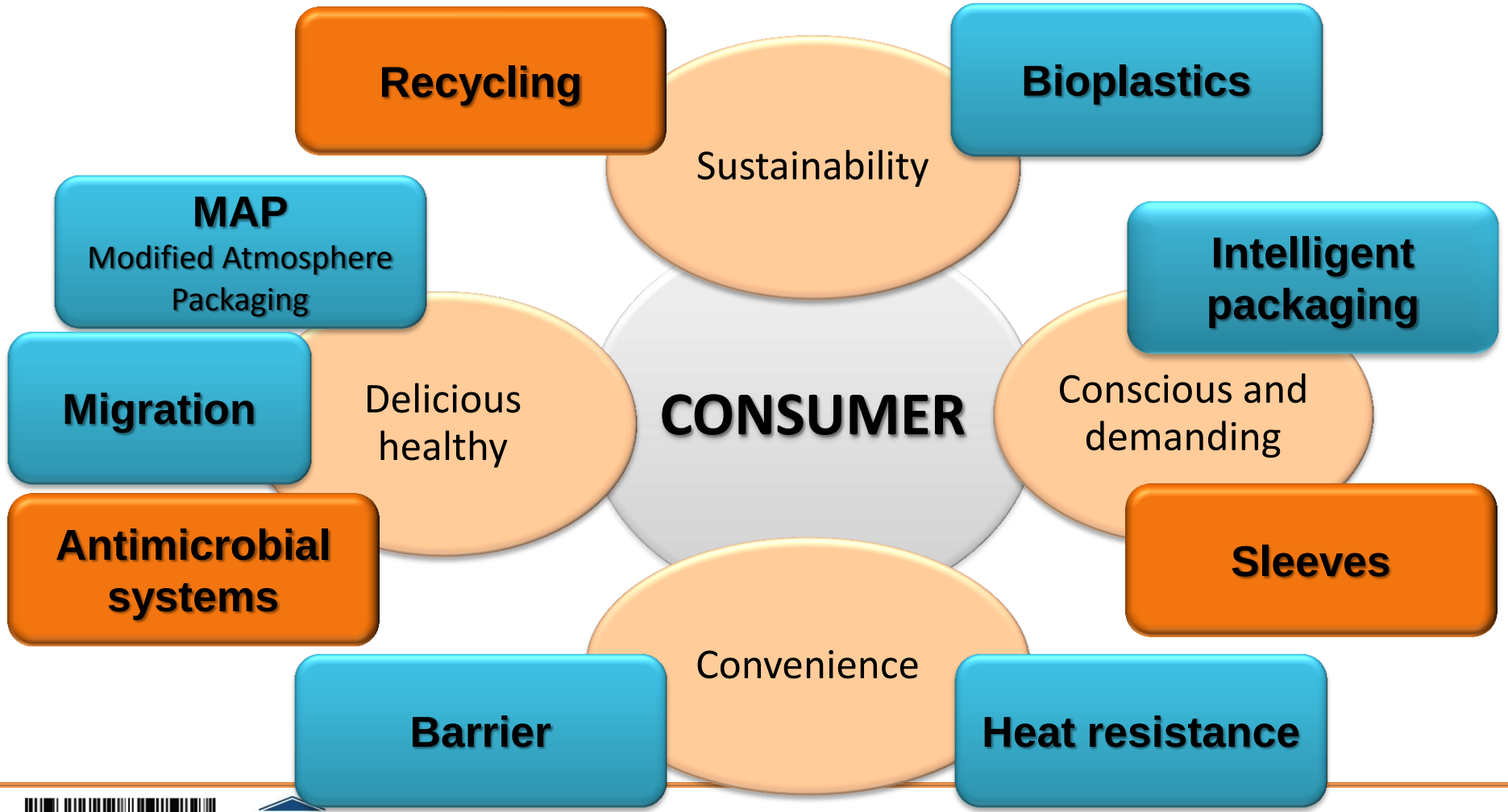
Training

Publications

Networking

© 2013 – Peter Ragaert

Activities Pack4Food
Research projects



© 2013 – Peter Ragaert

Active & intelligent packaging (Def. EU 1935/2004 and EU 450/2009)

- Active materials and articles:
  - Intended to extend the shelf-life of packaged food

    Or
  - To maintain or improve the condition of packaged food
  - Designed to deliberately incorporate components in food packaging that would release or absorb substances into or from packaged food or the environment surrounding the food.
- Intelligent materials and articles:
  - They monitor the condition of the packaged food or the environment surrounding the food

© 2013 – Peter Ragaert

Types active packaging

- Absorbing (scavenging)
  - O_2, CO_2, H_2O, ethylene, flavours, UV,…
- Releasing
  - Ethanol, CO_2, preservation agents,…
- Removing
  - Lactose, cholesterol,…
- Temperature control
  - ‘Self-heating’, isolating materials,…

© 2013 – Peter Ragaert

Types active packaging

- Types
  - Sachets, placed in packaging
  - Strips/labels, adhered at the inside of the packaging material
  - Component, blended in the packaging material
- Applications in food industry
  - O_2 absorbers in sachets
  - Ethanol emitters/generators
  - Ethylene absorbers
  - Liquid absorbers
  - Flavour absorbers
  - CO_2 emitters/absorbers
  - Antimicrobial coatings

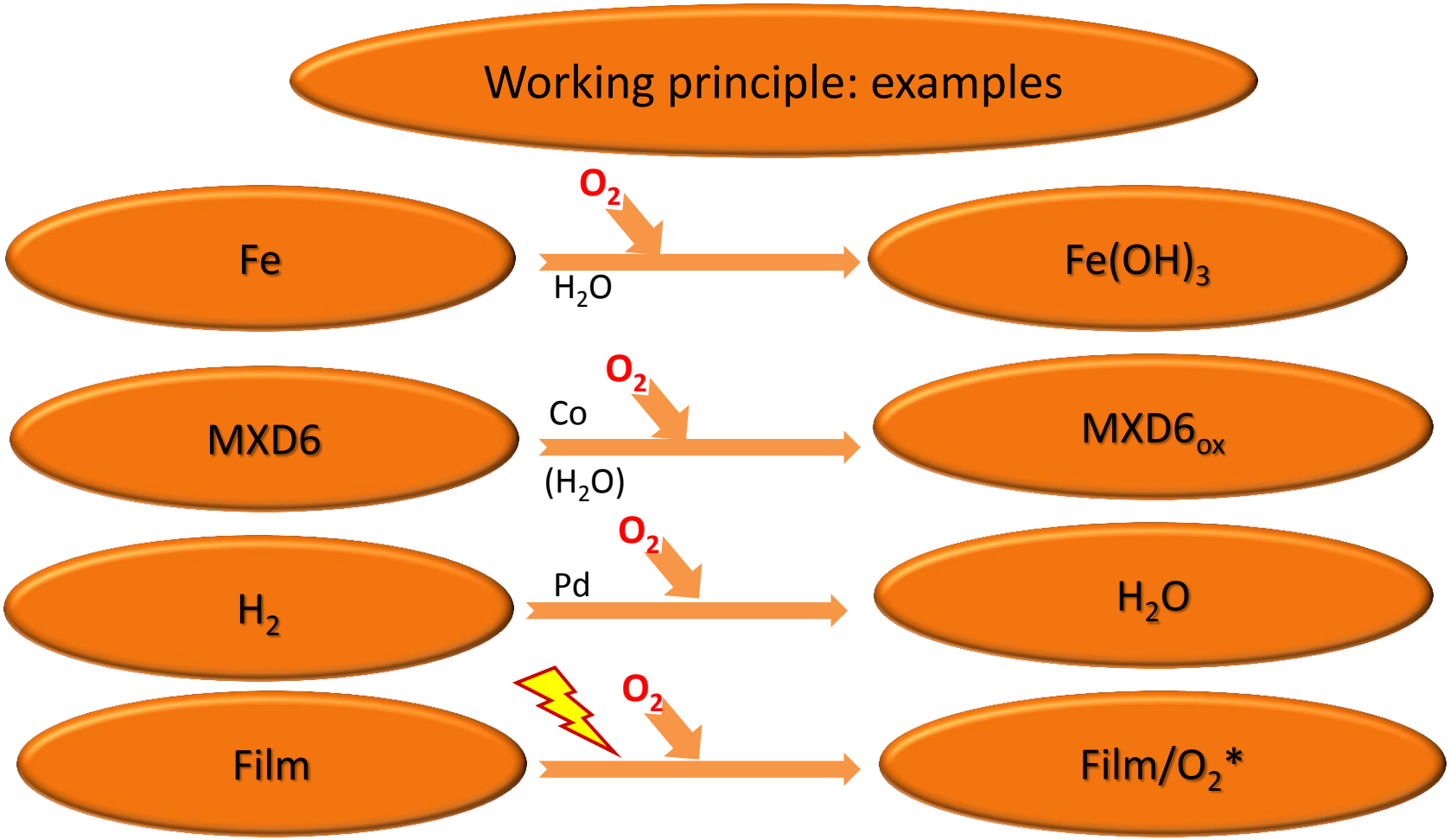
© 2013 – Peter Ragaert

O_2-absorber

- Function O_2-absorber:
  - After packaging step: remove residual O_2
    - From headspace
    - From the food product (e.g. liquids, porous products)
  - During shelf-life: avoid O_2-ingress
- Activation O_2-absorber
  - By humidity (e.g. Fe-based absorbers)
  - By light(e.g. absorbers based on light sensitive pigment oxidation)
  - No activation (e.g. adsorption to material)

© 2013 – Peter Ragaert

Chemical O_2-absorbers



© 2013 – Peter Ragaert

Examples
O_2-absorbers (sachets / labels)

Photo: ATCO

Photo: FreshCare

© 2013 – Peter Ragaert

Examples
O_2-absorbers (sachets / labels)

Tianhua Tech Co. Ltd

FreshPax ®

ATCO

MULTISORB Technologies

© 2013 – Peter Ragaert

Examples O_2-absorbers (integrated/blended in the packaging material)

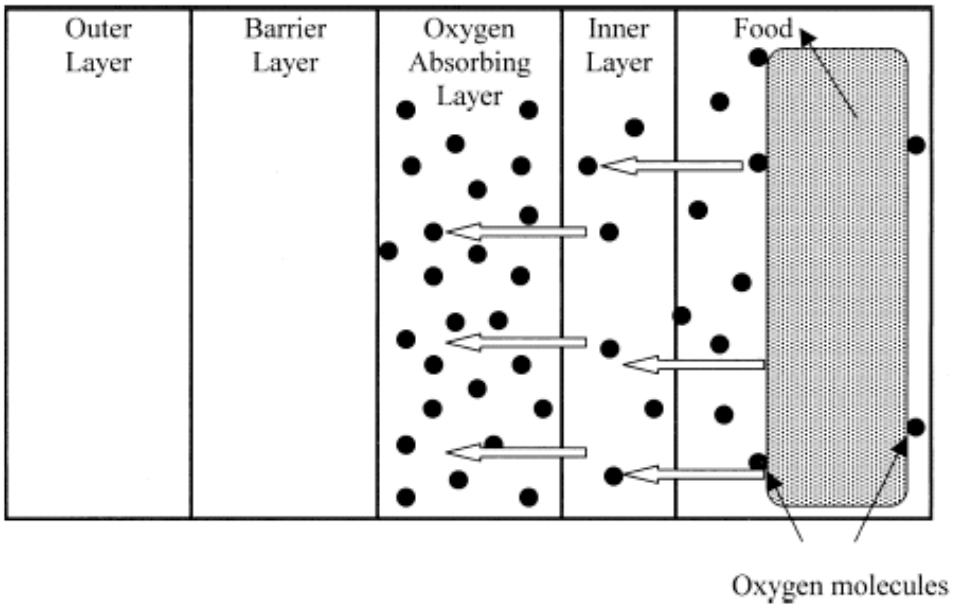


Fig. A typical multi-layer film structure with integrated O_2-absorber (Ozdemir and Floros, 2004)

Example: Shelfplus™ – **Albis**

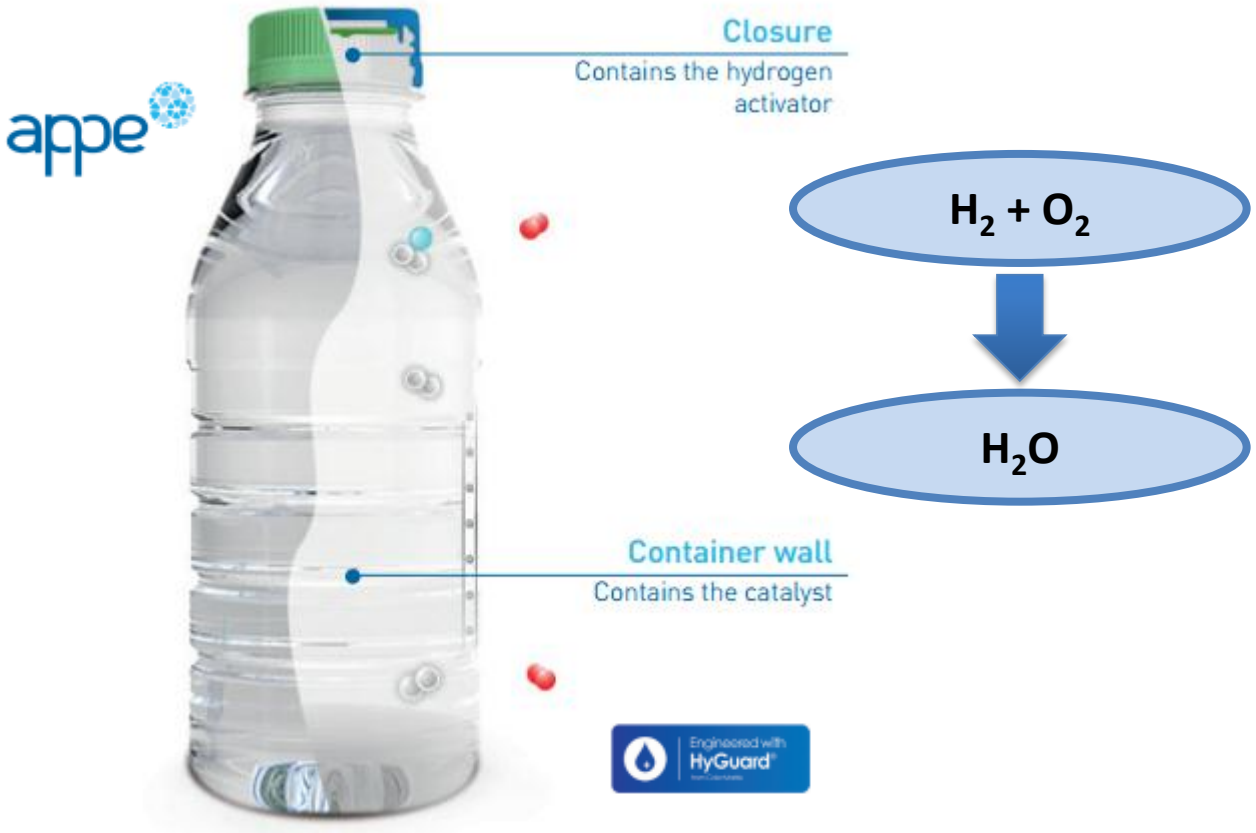
- Iron-based O_2-scavengers
- Grades available for:
  - PE
  - PP
  - PA
  - EVA

ALBIS

© 2013 – Peter Ragaert

Case: application O_2-absorber in bottles

- ActivSeal®



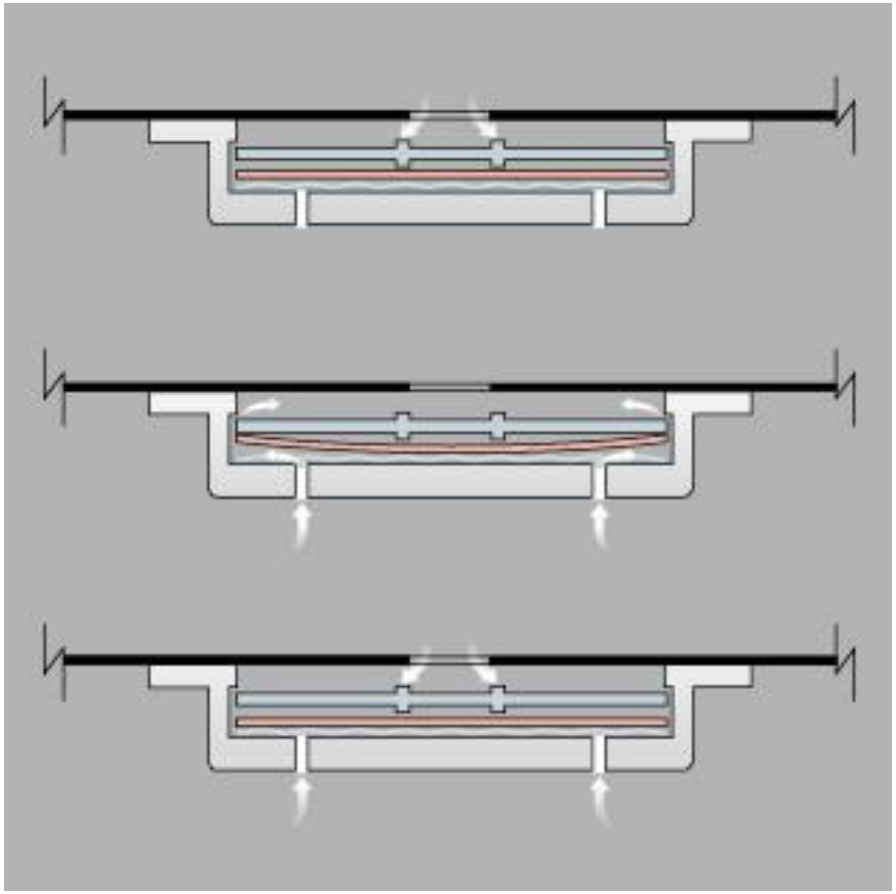
© 2013 – Peter Ragaert

Case: application O_2-absorber in retort-sector

- Compensation retort-shock through incorporation of O_2-absorber in EVOH-layer
- Preservation of O_2-barrier for long shelf-life products
- E.g. research cooperation in 2009 between Tartex, Dr. Ritter, Säntis J. Goldi, EVAL Europe, Ciba Specialty Chemicals

© 2013 – Peter Ragaert

CO_2 valves



Source: wicovalve.com

© 2013 – Peter Ragaert

Antimicrobial packaging

- Active components
  - –Ag^{2+}-ions, chlorine dioxide, ethanol, triclosan, chitosan, natural herbs,…
  - –Bottlenecks / challenges:
    - Radius of action?
    - Temperature resistance?
    - Sensory effect towards food?
  - –Examples: Irgaguard® B, BactiBlock®, Negamold®

© 2013 – Peter Ragaert

Other active materials

- Ethylene absorbers

Revolutionary ethylene absorber is 'berry' good - Marks and Spencer

By Rory Harrington, 09-Jan-2012

Related tags: Ethylene absorber, Active packaging, Shelf life, Quality, Marks & Spencer

Related topics: Going green, Packaging, Primary Packaging, Europe

Marks & Spencer (M&S) said it has become the first retailer to use a *"revolutionary"* ethylene strip in strawberry punnets at the point of sale that will extend the shelf life of the fruit by up to 50%.

The UK-based company said the *"exclusive technology"* will boost typical shelf life of strawberries kept in fridges from four to six days thanks to an ethylene absorbing band. Ethylene is the hormone that causes fruit to ripen and then turn mouldy.

RELATED NEWS:

Tesco adopts shelf-life extending ethylene-absorbing packaging

- Microwave susceptors:
  - –transform microwave energy in heat
  - –examples
    - •thin layer of metal (e.g. aluminium) on polyester layer
    - •finely dispersed Alu-particles in tray

© 2013 – Peter Ragaert

Active & intelligent packaging (Def. EU 1935/2004 and EU 450/2009)

- Active materials and articles:
  - Intended to extend the shelf-life of packaged food

    Or
  - To maintain or improve the condition of packaged food
  - Designed to deliberately incorporate components in food packaging that would release or absorb substances into or from packaged food or the environment surrounding the food.
- Intelligent materials and articles:
  - They monitor the condition of the packaged food or the environment surrounding the food

© 2013 – Peter Ragaert

Intelligent packaging

- Extension of communication function of traditional packaging

- Communicates information to consumers based on its ability to sense, detect, or record external or internal changes in the product's environment

© 2013 – Peter Ragaert

Types of intelligent packaging

In general: **two types**

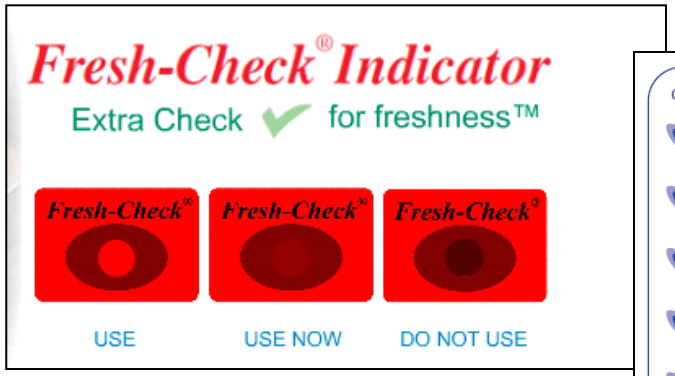
1. Measuring the **condition of the package** on the outside

2. Measuring directly the **quality of the food product** inside the packaging

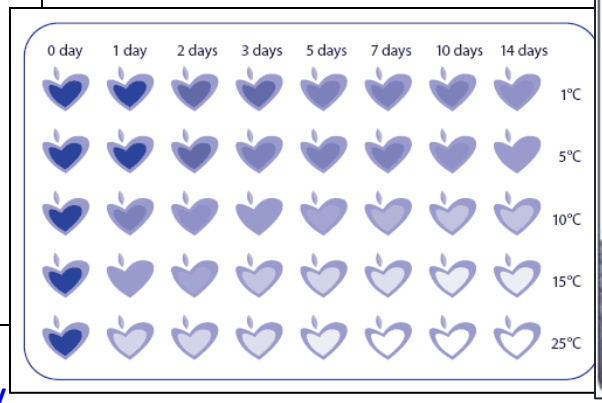
© 2013 – Peter Ragaert

Time-Temperature Indicators (TTI)

- Integrating exposure of packaged food with time and temperature (t x T)
- Colour changes due to mechanical, chemical, electrochemical, enzymatic or microbiological reaction



TempTime
http://www.temptimecorp.com/



OnVu
http://www.onvu.com/

Innolabel
http://www.innolabel.eu/

© 2013 – Peter Ragaert

Time-Temperature Indicators (TTI)

- Applications
  - Monitoring cold chain
  - Monitoring product quality: Importance of thorough knowledge of microbiological and chemical quality loss in the food product in function of temperature during development of TTI's

© 2013 – Peter Ragaert

Quality indicators

- Colour change depending on changes in quality of the food product
  - Flavour components, ethylene,…
  - Microbiological metabolites,…
- Not much commercial applications
- Lots of research/patents
- Focus on:
  - Following up ripening processes (e.g. fruits)
  - Following up amine-production (e.g. fish)

© 2013 – Peter Ragaert

Quality indicators

- Ripesense ®

Ripesense.com

© 2013 – Peter Ragaert

Quality indicators

- SensorQ™ (Food Quality Sensor International / DSM)
  - pH-sensing technology (based on anthocyanines)
  - Detects freshness/spoilage level of packed meat and poultry by reacting with biogenic amines from microbiological origin
  - Label
  - Orange-colored center in ‘Q’ turns dark green if meat is spoiled

Photo: PackWorld.com

© 2013 – Peter Ragaert

Intelligent materials – new research project

- CheckPack (IWT-SBO-130036)
  - Integrated optical sensors in food packaging to simultaneously detect early-spoilage and check package integrity
  - Start: November 2013

Vlaams innovatienetwerk met steun van IWT

UNIVERSITEIT GENT

FOOD 2 KNOW

PLATEAU PHOTONICS INNOVATION CENTER

Vrije Universiteit Brussel

KATHOLIEKE UNIVERSITEIT LEUVEN

Radboud Universiteit Nijmegen

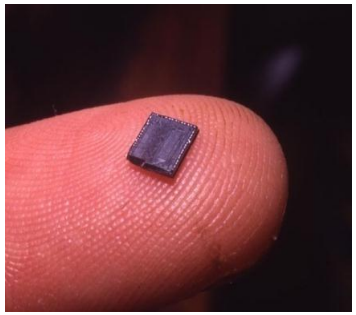
© 2013 – Peter Ragaert

Intelligent materials – new research project CheckPack (IWT-SBO-130036)

MAP-packages of meat, fish, vegetables and fruits

Integration optical sensors with specific coating for…

Adsorption and detection of **volatile compounds** in packages of food products



Adsorption and detection of CO_2 in packages of food products

Fast, accurate and non-destructive analysis of quality packaged food products ánd of integrity packaging concept (leak detection)

© 2013 – Peter Ragaert

Other intelligent materials

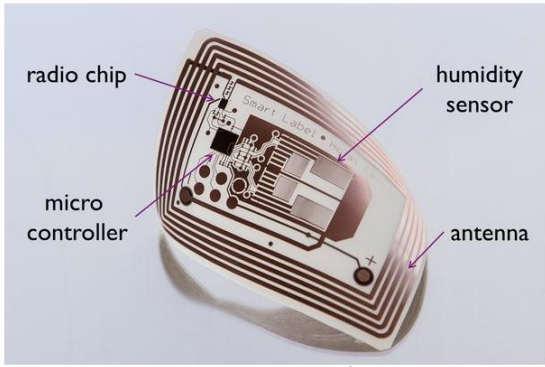
- Inks sensitive to temperature changes

Smart Lid Systems (Sydney, Australia)

- LED in food packaging?

- Flexible electronics in food packaging?

Cmst



www.cmst.be

© 2013 – Peter Ragaert

Legislative aspects

- Commission regulation (EC) 450/2009 on active and intelligent materials and articles intended to come into contact with food
  - Article 3: definitions
    - Active and intelligent materials
    - Functional barriers
    - Released active substances
  - Article 4: refers to:
    - Regulation (EC) 1935/2004 (materials and articles intended to come into contact with food)
    - Regulation (EC) 450/2009
  - Article 5: Community list
  - Article 11: Labelling
  - Article 12: Declaration of compliance and documentation

© 2013 – Peter Ragaert

Pack4Food

Dare to innovate in food packaging!

Pack4Food
Coupure Links 653
9000 Ghent
Belgium

Tel: +32 (0)9 264 99 30
Tel: +32 (0)9 264 99 39
www.Pack4Food.be
www.PredOxyPack.be

Member of – partner of:

Flanders PlasticVision Innovative cluster

SFF SENSORS FOR FOOD

iapri

ECOBIOCAP Ecoefficient Biodegradable Composite Advanced Packaging

FOOD 2 KNOW UGent

COHESI

easyFairs EMPACK

the PackagingPeople Networking Information Knowledge

EHEDG European Hygienic Engineering & Design Group

FoodGate netwerk voor innovatie