

Intro to Product Structures

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Presented by:

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△ DuPont Packaging & Industrial Polymers



Sharing Secrets

Product Structures.....

- u Most of what is produced by extrusion coating and lamination, winds up as some type of packaging material...
- u But there are also many industrial laminates produced.
- u For this discussion we will talk mainly from the perspective of packaging, but the principles of thought apply to most web forms.

Fresh meat ...

Packaging meat ...

Packaged meat....

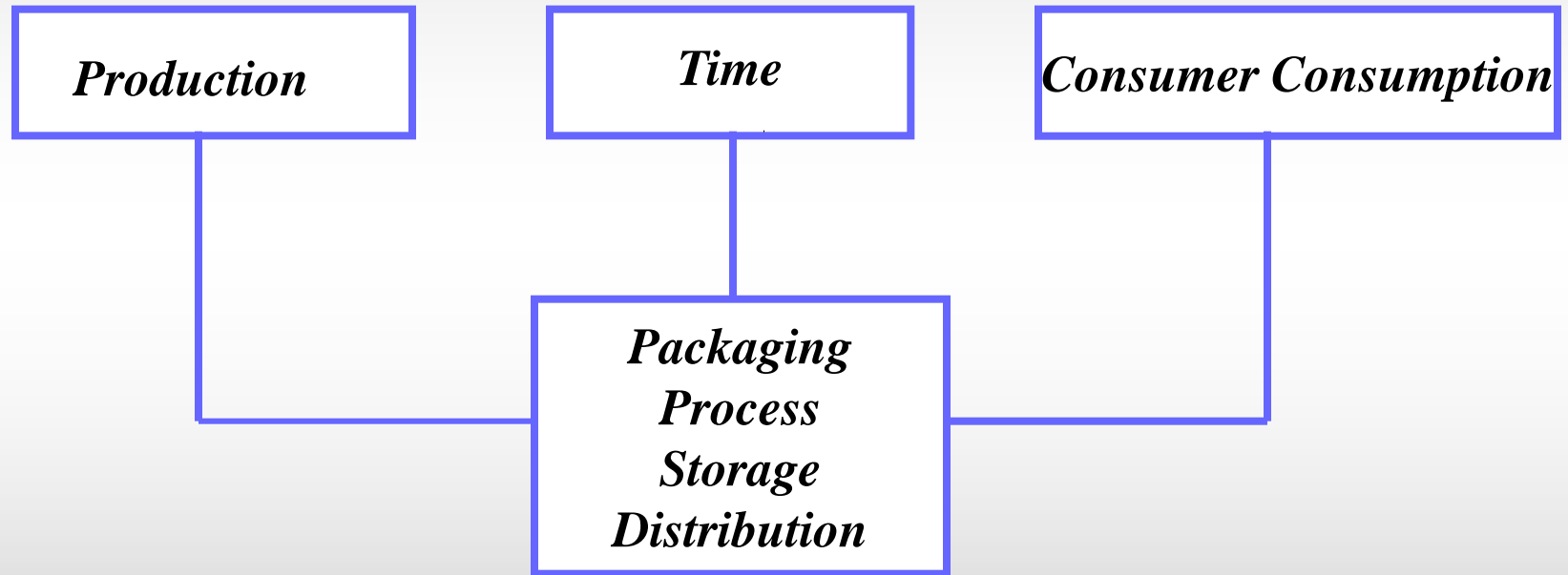
Processed meats in packages....

Sliced packaged processed meats.....

Just a few chickens.....

Packaged Chicken

Functions of Packaging



DESIGN CONSIDERATIONS

- u Product
- u Desired Appearance
- u Packaging Machinery
- u Handling & Distribution
- u Converting Capability
- u Cost

Typical Components of a Packaging Structure

Surface layer / Bulk layer / Barrier layer / Sealant layer

E.g.

- OPET / LDPE / Alu foil / LDPE
- OPP / PE / vmPET / adh // LLDPE
- (LLDPE - LDPE - tie - EVOH - tie - LDPE - EVA)

DESIGN CONSIDERATIONS

SURFACE FILM :

- » Printability
- » Melt Temperature - higher than sealant

BULK LAYER :

- » Thickness / Feel
- » Machine-ability

BARRIER LAYER:

- » Solvent / Moisture / Oxygen Barrier

SEALANT LAYER:

- » Seal Temperature
- » Seal Properties

Typical Surface layer choices

Types:

- u OPET
- u BOPP
- u BONY
- u Paper
- u Cellophane
- u Foil (Can function as a barrier film as well)
- u LLDPE, PP, HDPE, (higher melt point polyolefins)

Film Selection Criteria

Thermal Stability - Conductivity, Shrink & Printability

Surface properties - COF, Additives

Static, Surface energy, Durability

Physical Properties - Tear, Brittleness, Melt point,
Formability, Stiffness

Optical Properties - Clarity, Haze & Gloss

Other - Chemical resistance, Odor barrier, OTR, WVTR

BULK LAYER CHOICES

u Types:

- LDPE, LLDPE
- EVA
- Acrylate copolymers
- Acid copolymers
- tie layer resins

u Criteria

- Cost
- Adhesion
- Flexibility
- Softness
- Stiffness
- etc.....

BARRIER LAYER CHOICES

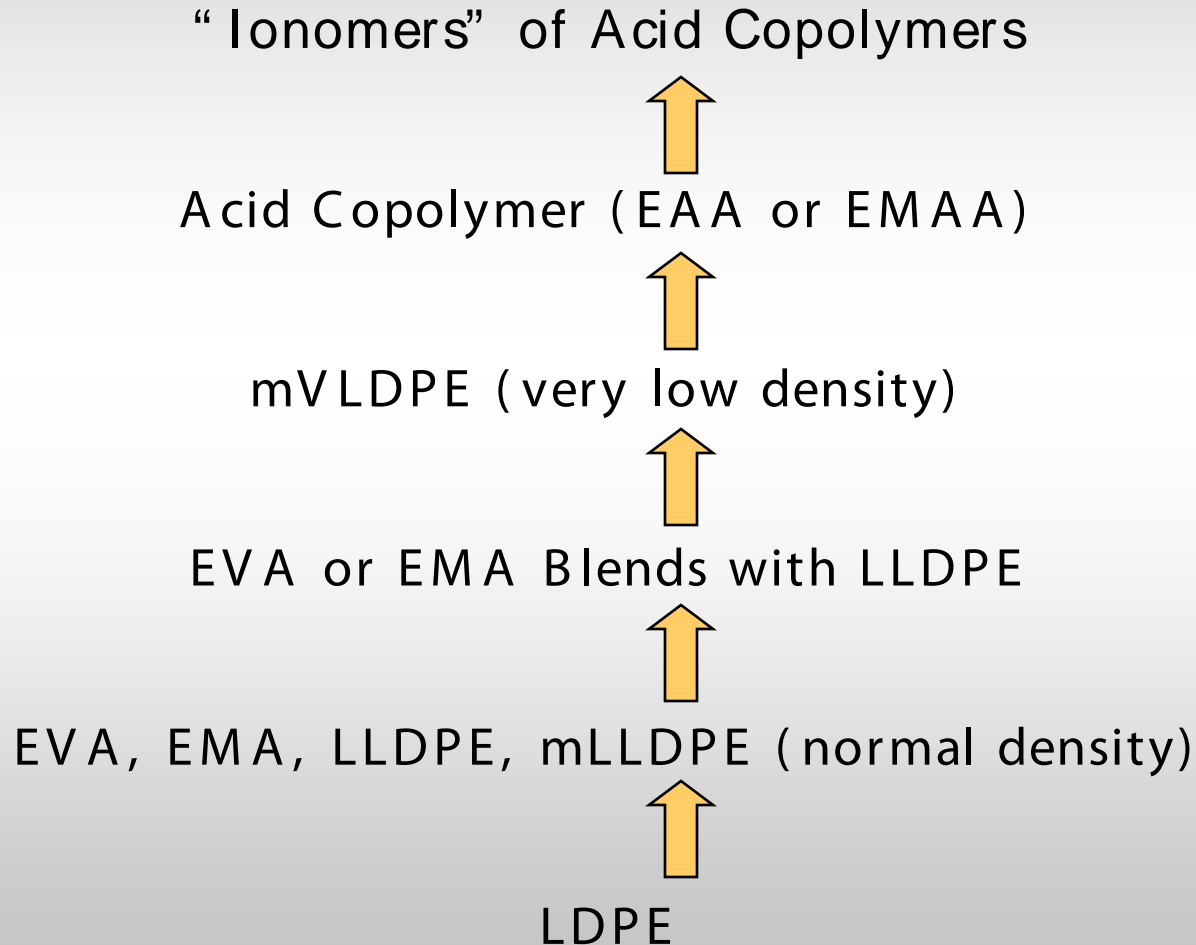
Types

- u Foil
- u vmPET
- u PVdC coated Cello, OPP, OPET
- u PVOH coated PET
- u Nylon film (oriented usually)
- u **Nylon**
- u **EVOH**
- u PVdC
- u PVOH
- u PGA, PET, PEN, PLA, COC, “Barex”

u Criteria

- barrier needs
- cost
- flex durability
- clarity needs

SEALANT LAYER CHOICES



Sealant Layer Criteria

- u Cost....
- u Seal temperature
- u Seal speed (hot tack needed)
- u Seal through contamination
- u Seal strength
- u 'E-Z' tear desired, or not
- u etc.....

Tetrahedron package.....

NUTS to you.....

Resin Selection Criteria

Melt Index - MW & MWD

(Physical properties, tensile strength, organoleptics)

Density – Crystallinity

(opticals, permeability, modulus)

Molecular Branching – Long and Short

(Melt Strength, processing parameters)

Comonomer Content - All properties

Melt Point - Crystallinity

(seal initiation temp., thermoforming)

Resin Selection Criteria

u Recommendation...

- Understand the application needs...
 - **Talk with your enduser customer**
- Understand the converting capabilities...
 - **Both film converting, and packaging**
- Talk with your resin suppliers...
 - **There are many resin choices**

Which way to go?

Structure Troubleshooting...

- u 1st thing...
 - What is the structure involved ?
- u 2nd thing...
 - Are you sure you understand what the structure is, and how it was produced, based on the way someone wrote it, or described it to you ?
- u What can we do in the future to help lessen confusions on this matter ?
 - ... a suggested guide for writing perhaps ?

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Guide to Multilayer Structure Writing:

u Key Definitions:

– Primer

- This is usually associated with extrusion coating.
- a bonding agent that is applied in a liquid form to a solid surface. It is intended to promote the adhesion of another liquid or molten material that will subsequently be applied on top of the primer. Typically it is dried, prior to having the subsequent material applied to it. (This is usually associated with extrusion coating.) In some parts of the world these are referred to as anchor coatings ('AC'). Adhesion generally increases after curing time.

Guide to Multilayer Structure Writing:

u Key Definitions:

– Adhesive

- This usually is associated with water based, solvent based, or solventless dry lamination.
- a bonding agent that is applied in a liquid or paste form to one or more solid surfaces. It is intended to promote adhesion of the solid surfaces to one another. The adhesive is typically dried, and then the solid surfaces are brought together with heat and/or pressure to activate the adhesive. (This usually is associated with water based, solvent based, or solventless dry lamination.) Adhesion generally increases after curing time.
- *** can be abbreviated as “ADH”.

Guide to Multilayer Structure Writing:

- “ / ” --- indicates the boundary between a solid interface and a liquid or molten material being applied to it.
- “ // ” --- indicates the boundary between two solid surfaces, one of which is a film, and the other of which is a film that is coated with an adhesive. (Typical for adhesive lamination.)

Guide to Multilayer Structure Writing:

u Key Symbols:

- “()” --- a set of parentheses. These indicate that the materials within are being coextruded. Look for a dash “ - “ sign between materials.
 - “ - “ --- indicates the boundary between two molten materials being coextruded together. They should be enclosed in a set of parentheses, “()”.. Use a space on each side of the dash.

Guide to Multilayer Structure Writing:

- u “[]” --- a set of straight sided brackets. These indicate that the materials within are being blended. If known, percentages by **weight ratio** for the materials being blended should be indicated. Look for a plus sign between the materials.
 - “ + “ --- indicates two materials being blended together. They should be enclosed in a set of straight-sided brackets, “[]”. Use a space on each side the plus.

Guide to Multilayer Structure Writing:

- u For an extensive list of abbreviations, some other symbols, and samples of various structure writing examples, please contact:
 - Scott B. Marks --- DuPont Company



April 2009 -
Structure Writing i

Multilayer Structure writing examples:

u **OPET / ink / adhesive // CPP**

- *** an adhesive lamination of cast polypropylene film to reverse printed polyester film. An adhesive of unknown type is applied to the printed surface of the polyester film.

u **OPP / primer / CoPP**

- *** an extrusion coating of copolymer polypropylene on to an unprinted polyester film. There is a primer of unknown type applied to the OPET.

u **48ga OPET / ink / PEI primer / 28# LDPE**

- *** a reverse printed 48 gauge OPET film that is primed with a PEI primer, and then extrusion coated with 28 pounds per ream of low density polyethylene.

Multilayer Structure writing examples

- u (**LLDPE – W.O.LLDPE – LDPE**) film / **EAA** / **alu** / **EAA** / (**LDPE – LLDPE**) film
 - *** an extrusion lamination with EAA of a three layer film to one side of the alu. The outer film is white, but the pigment is only in the middle layer. The other side of the alu has a two layer film extrusion laminated to it with an EAA

Multilayer Structure writing examples

- u **OPET / primer / (LDPE – [LDPE + white MB]-LDPE) / foil / 25u EMAA**
 - *** an OPET film which is primed, and then has foil extrusion laminated to it using a three layer coextrusion, with the center layer containing a white masterbatch. The foil is then extrusion coated on the other side with an EMAA copolymer.

Multilayer Structure writing examples

- u **(LLDPE – W.O.LLDPE – LDPE) film / LDPE / primer / VM-OPET / primer / LDPE / (LDPE – LLDPE) film**
 - *** a three-layer film is extrusion laminated with LDPE to a metallized OPET. Primer is applied to the metallized side. A primer is then applied to the plain side of the VMPET, and it is extrusion laminated with LDPE to a two-layer coex film
- u **LDPE / ink / 18 pt. Board / LDPE / alu / (EMAA - LDPE)**
 - *** 18 Point Paperboard that is surface extrusion coated with LDPE, and then extrusion laminated with LDPE to alu. The other side of the alu is then coextrusion coated with a combination of EMAA and LDPE.

Multilayer Structure writing examples

- u (**PP – tie A – Nylon 6 – EVOH – Nylon 6 – tie B – ionomer**)
 - *** a seven layer coextruded film. The tie layer resins are not known, but it is known that there are two different grades being used in the one structure. You will need to specify whether it is made by a cast film or blown film process.
- u (**Nylon – tie – Nylon – tie – LDPE – mPE – ionomer**)
 - *** a seven layer coextruded film. The tie layers are believed to be the same, so are not labeled differently. An mPE is used to adhere the ionomer to the LDPE. Try to find out the density of the mPE in this type of application. You will need to specify whether it is made by a cast film or blown film process.

Multilayer Structure writing examples

- u This system of writing works well for *blow molding, sheet extrusion, and various lamination processes too.*
- u It can also be used to incorporate notes for *use of flame, corona, plasma, and ozone treatment processes.*

Thank You

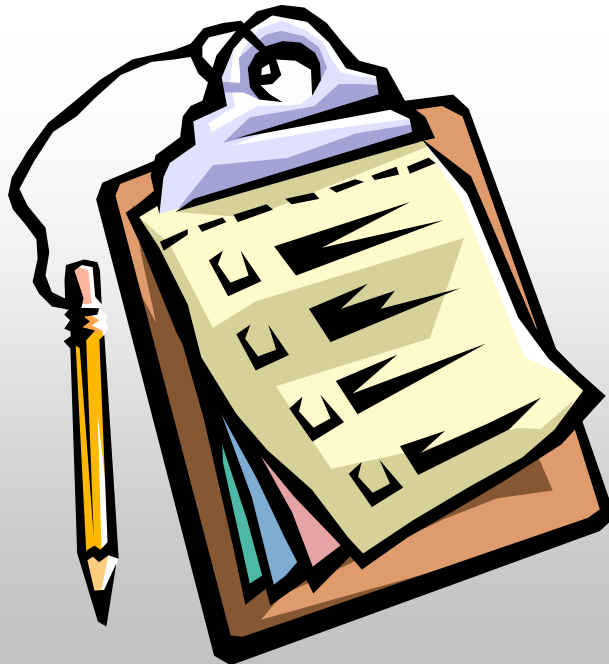
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*Please remember
to turn in your
evaluation
sheet...*

