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## Writing Guide for Packaging Films and other Multilayer structures:

**A wide variety of multilayer structures are used in the flexible and rigid packaging industry, which are put together by an assortment of techniques including: extrusion coating, extrusion lamination, adhesive lamination, as well as coextrusion blown film, cast film, cast sheet, and blow molding.** There currently is no standard method for communicating structures in a written format between companies (and for the most part, even within companies). The guidelines described below were derived from formats consolidated by the author during his long career working international markets. Although no one method is best, we have found this guide to be useful in that it presents a systematic way to not only communicate the components of the structure, but also the technology used to put it together. By following the guidelines, one can better understand whether, for example, a structure is manufactured using coextrusion or by tandem extrusion coating. Such concise writing can improve communication. Therefor we offer these guidelines in the hope that they will increase communication effectiveness and understanding between all persons in our industry. The formatting guidelines allow for use in hand-written communication or for typing using a keyboard or keypad.

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## Guide to Multilayer Structure Writing:
## Packaging and Industrial Applications

### Key Definitions:

**Primer** --- 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.

**Adhesive** --- 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 active 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**", or **"adh".**

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### Key Abbreviations:

**VM** --- a vacuum metallization process for applying a thin metal layer to a solid surface, for example OPET or OPP films. This can also be applied to paper, printed surfaces, and other materials. The metal is usually aluminum, but can also be other metals such as copper, gold, tin, etc. (If it is not aluminum, please specify in your communication.)
"**vm**" is an alternate abbreviation for "vacuum metallized."
"**met**" is an abbreviation for "metallized".

**SiOx** --- a silicon oxide coating that is typically applied to a film such as OPET. The coating is applied in a vacuum deposition process. The coating is usually transparent.
**O.L.** --- an overlacquer that is applied over ink to typically add scratch protection and gloss.
**W.O.** --- "white opaque", indicates that a material is pigmented with a white colorant to create opacity.
**Tie** --- generically indicates a coextrudable adhesive resin. This is used in structure notations when the resin brand / grade are unknown. If the tie material base resin is known then please indicate:

E.g. --- LLDPE tie, EVA tie, PP tie, etc.

If the brand is known, please indicate, such as Dow Bynel™ or Mitsui Admer®. If the grade number is known, please indicate as well.

**MB** --- indicates a "masterbatch" or concentrate. This could be for pigments such as TiO2 (white MB) or for slip and antiblock concentrates.

E.g. --- white MB, slip MB, A/B MB, etc…

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**Key Symbols:**

"**/**" --- indicates the boundary between a solid interface and a liquid or molten material being applied to it.

For example: **OPET / ink / primer / 33u EMAA**

*** an oriented polyester film is printed with one or more inks, and dried. The printed surface then has a primer applied to it, dried, then extrusion coated with 33 microns of an EMAA resin.

"**( )**" --- a set of parentheses. These indicate that the materials within are being coextruded.
Look for a dash " **-** " sign between materials. The dash 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.

For example: **( 1 mil LDPE – 2 mil EAA )**

*** a two layer coextruded film of low density polyethylene and EAA.

"**[ ]**" --- 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. The plus 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.

For example:

**( [75% Nylon 6 + 25% Amorphous PA] – tie – LLDPE )**

*** a blend of Nylon 6 and Amorphous Nylon, in the **weight ratios** indicated, is the outer layer of a three layer coextrusion. The middle layer is an unknown coextrudable adhesive resin, and the inner layer of the coextrusion is a LLDPE.

"**//**" --- indicates the boundary between two solid surfaces, one of which is a film, and the other of which is a film that is often coated with an adhesive. (Typical for adhesive lamination.)

For example: **OPET / adhesive // 25u ionomer film**

*** an oriented polyester film that has an adhesive applied to it and dried. A film of ionomer is then combined to this typically through a heated nip roll to activate the adhesive.

"**//TL or BL//**" --- indicates the boundary between two warm solid layers that are joined together by only heat and pressure. Examples would be:

**"//TL//"** Thermally laminated films. Two films (or one film and one foil), combined typically between rubber rolls, following preheating of one or both films.

**"//BL//"** A "**B**locked **L**amination". Blown films that are intentionally blocked in the collapsing nip. In addition, if a coextruded film, surround the structure with curved brackets, "**{}**", to indicate a combined web of coextrusion. See examples in the following pages.

**" < " or " > "** --- indicates direction to which some type of surface treatment has been applied, such as flame, corona, ozone, plasma.

For Example --- **Paper < flame / LDPE / foil / LDPE**

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**Materials (generic representations)**:

**Webs / Films / Substrates:**

**OPET** --- biaxially oriented polyester film. (Occasionally called **BOPET**.)
*** Writing "**OPET**" for a film will prevent confusion with extruded PET.
**vm-OPET** --- vacuum metallized OPET film. Metallization on the left.
*** also known as "met-PET" or "met-OPET"
**OPET-vm** --- vacuum metallized OPET film. Metallization on the right.
*** also known as "PET-met" or "OPET-met"
**OPET-SiOx** --- OPET film with silicon oxide on the right side of the film.
**SiOx-OPET** --- OPET film with silicon oxide on the left side of the film.
**OPET-PVdC** --- oriented polyester film with a PVdC coating on the right.
**PVdC-OPET** --- oriented polyester film with a PVdC coating on the left.
**PVdC-OPET-PVdC** --- oriented polyester film, two side coated with PVdC.

**OPP** --- biaxially oriented polypropylene film, also known as BOPP.
**BOPP** --- biaxially oriented polypropylene film, also known as OPP.
**vm-OPP** --- oriented polypropylene film, with metallization on the left side
**OPP-vm** --- oriented polypropylene film, with metallization on the right side
**OPP-A** --- oriented polypropylene film, with an acrylic coating on the right side
**A-OPP** --- oriented polypropylene film, with an acrylic coating on the left side.
**CPP** --- cast polypropylene film
**vm-CPP** --- cast polypropylene film with metallization on the left side.
**CPP-vm** --- cast polypropylene film with metallization on the right side.

**C-Nylon** --- cast nylon film, also written as **Cast PA** for cast polyamide film.
**O-Nylon** --- uniaxially oriented nylon film
**BONy** --- biaxially oriented nylon film
**BOPA** --- biaxially oriented polyamide (nylon) film
**K-Nylon** --- biaxially oriented nylon film, with PVdC on one side
**BONy-PVdC** --- "K-Nylon", but written to specify PVdC on the right side.

**Alu** --- aluminum (aluminium), can also be written as "**AL of alu**".
**Foil** --- typically refers to thin aluminum. Can be used for other metals, so if it is not aluminum, please specify. Examples: tin foil, gold foil, ...

(In Europe sometimes the word "foil" is used to indicate any type of thin film, and can cause communication issues globally.)

**Cello** --- plain, uncoated cellophane
**K-Cello** --- two-side PVdC coated cellophane
**NC-Cello** --- two-side nitrocellulose coated cellophane

**Paper** --- use for lightweight paper based webs.
*** There are various types, so please specify when possible:
Kraft, Bleached Kraft, SBS, clay coated, etc.
**Board** --- use for heavy weight paper based webs. Various types exist.
Please specify when possible.

**Nonwoven** --- generic for nonwoven webs if the type or brand is not known.
*** Nonwoven HDPE, Nonwoven PP, Nonwoven PET, -- please specify
*** use brand name if known; such as DuPont Tyvek®, BerryGlobal Reemay®, BerryGlobal Typar®, Mitsui Tafnel®

**Woven Fabric** --- use for generic fabric weaves, with a "tight weave"
*** woven PP, woven HDPE, woven PP

**Scrim** --- use for woven mesh type fabrics with an "open weave"
*** Scrim PP, Scrim PET, Scrim HDPE

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**Thickness or Gauge representations:**

**#** --- usually means, "pounds per ream" (typically a ream being 3000 square feet)
**mils** --- used for the English measurement of 0.001 or 1/1000 of an inch.
**inches** --- English unit for thick layers, such as in bottles and sheet applications.
**u** --- abbreviation for micron of the Metric measurement, or 0.001 or 1/1000 of a millimeter.
**mm** --- millimeters, metric unit used for thick layers, such as in bottle and sheet applications.
**gsm** --- grams per square meter
**pt.** --- usually means, "point", which is a unit of thickness for paperboard. 1 point = 1 mil or 0.001"
**ga** --- used to indicate the "gauge" or thickness of a film in some systems.
100ga = 1 mil = 25.4u
E.g. --- 48 ga = 12u = 0.5 mils

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**Adhesives and Primers:**

**PUR** --- polyurethane; **PUR adhesive** or **PUR primer**; can be solvent or water based.
**PEI** --- polyethylene-imine; **PEI primer**, usually a water based primer
**EAA** --- ethylene acrylic acid; **EAA primer** (water based)
**EAC** --- ethylene acrylate; **EAC primer** (water based)
(*** there are others in use, though less common to our industry, for example organic titanates)

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## Surface Treatments:

**Corona** --- electron discharge excitement of atmospheric air over a material surface.
**Plasma** --- electron discharge excitement of a gas other than standard air over the material surface. Examples would include: nitrogen, argon, helium, neon, hydrogen, etc., as well as various gas mixtures.
**Flame** --- surface treatment with burning gases. The gas mixture could be either an oxidizing flame, a reducing flame, or a stoichiometric flame.
**Ozone** --- molten web oxidation by exposing the polymer to a dry ozone flow created off-line and pumped to the molten web area, through a tube with small outlet holes along its length. When used it is typically seen on an extrusion coating line versus other processes.

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## Extrudable Resins:
**(generic names for when brand and/or grade are unknown.)**

**HDPE** --- high density polyethylene
**HMW-HDPE** --- high molecular weight HDPE
**MDPE** --- medium density polyethylene
**LDPE** --- low density polyethylene
**LLDPE** --- linear low density polyethylene
**VLDPE** --- very low density (linear) polyethylene; (also known as - VLLDPE)
**ULDPE** --- ultra low density polyethylene (also known as - ULLDPE)
**mPE** --- metallocene polyethylene, generic.
**mLMDPE** --- metallocene linear medium density polyethylene
**mLLDPE** --- metallocene linear low density polyethylene
**mVLDPE** --- metallocene very low (linear) density polyethylene, (sometimes referred to as a 'plastomer').

**PP** --- polypropylene; (generic indication when minimal information is known).
**CoPP** --- copolymer polypropylene
**HoPP** --- homopolymer polypropylene

**ACR** --- acid copolymer resin, generic name for EAA and EMAA resins
**EAA** --- ethylene acrylic acid copolymer, such as Dow Nucrel™, ExxonMobil Escor®, SK Primacor™
**EMAA** --- ethylene methacrylic acid copolymer, such as Dow Nucrel™.
**Ionomer** --- generic name for ionomeric copolymer resins, such as Dow Surlyn™

**Acrylate** --- generic name for various acrylate copolymers, such as Westlake EMAC®, ExxonMobil Optema® Dow Elvaloy™ AC, SK Lotryl®
**EBA** --- ethylene butyl acrylate
**EEA** --- ethylene ethyl acrylate
**EMA** --- ethylene methyl acrylate
**EMMA** --- ethylene methyl methacrylate
**EiBA** --- ethylene iso-butyl acrylate
**EnBA** --- ethylene normal-butyl acrylate

**EVA** --- ethylene vinyl acetate, such as; Celanese Ateva®, Dow Elvax™, LyondellBasell Ultrathene®, ExxonMobil Escorene Ultra® *** If % VA is known, please indicate; for example 9% EVA, 15% EVA or 28% EVA

**PS** --- polystyrene
**EPS** --- expanded (or foamed) polystyrene
**HIPS** --- high impact polystyrene
**GPPS** --- general purpose polystyrene

**PVC** --- polyvinyl chloride
**PVdC** --- polyvinylidene chloride; polyvinyl di-chloride. Most commonly seen as a coating on a film, but there are also extrudable grades, such as SK Saran®, and Solvay Ixan®

**PA** --- polyamide, (**nylon); e.g.-** Advansix Aegis®, BASF Ultramid®, DSM Akulon®, or UBE Nylon
**Nylon** --- polyamide, when unspecified, quite often is **Nylon 6** in the packaging film industry
**Nylon 6** --- polymer from caprolactam (also written "**PA 6**")
**Nylon 6,6** --- polymer from adipic acid & hexamethylenediamine
*** also written as **"PA 6,6" or "PA 6:6" or "PA 66"**
**Nylon 6/6,6** --- copolymer of 6 and 6,6 types of polyamide;
*** also written as "**PA 6/6,6**" or "**PA 6:66"**
**Amorphous PA** --- amorphous nylon; such as; DuPont Selar® PA, or EMS Grivory®
**MXD6** --- crystalline nylon of the MXD6 type; Mitsubishi Nylon-MXD6
NOTE: *** other polymers exist: Nylon 11, Nylon 12, Nylon 6/ 12, etc…

**EVOH** --- ethylene vinyl alcohol, such as; Kuraray Eval™, Nippon-Gohsei Soarnol™
*** if the mole% ethylene is known, it should be indicated, for example: 32% EVOH

**PAN** --- polyacrylontrile, sometimes written as "ACN"
**SAN** --- styrene acrylonitrile copolymer
**AN-MA** --- acrylonitrile methyl acrylate copolymer, such as; MSM Poly Anobex®; Ineos Barex®(discontinued)
**ABS** --- acrylonitrile butadiene styrene copolymer
**LCP** --- liquid crystal polymer
**COC** --- cyclic olefin copolymer, such as; TAP Topas®, or Mitsui Apel®)
**PUR** --- polyurethane, extrudable type polymer.
**SBC** --- styrene butadiene copolymer, such as; Ineos Styrolution K-Resin®
**TPS** --- thermoplastic starch polymer, such as; Novamont MaterBi®, Kuraray Plantic™, others…
**PET** --- extruded polyester. Could be monolayer or in a coextrusion.
**PET ext.ctg.** --- extrusion coating of polyester
**APET** --- amorphous polyester
**CPET** --- crystalline polyester
**PETG** --- polyester copolymer with glycol
**PEN** --- polyethylene napthalate
**PTT** --- polytrimethylene terephthalate, such as DuPont™ Sorona®
**PLA** --- polylactic acid
**PGA** --- polyglycolic acid
**PHA** --- polyhydroxyalkanote
**PHB** --- polyhydroxybutyrate
**PBAT** --- polybutylene adipate terephthalate
**PHBV** --- poly-hydroxybutyrate-hydroxyvalerate

**Terpolymers:**
**EVACO** --- terpolymer of ethylene, vinyl acetate, and carbon monoxide
**EnBACO** --- terpolymer of ethylene, normal-butyl acrylate, and carbon monoxide
**EnBAgMA** --- terpolymer of ethylene, normal-butyl acrylate, and glacial methacrylate.
**EiBAMAA** --- terpolymer of ethylene, isobutyl acrylate, and methacrylic acid
**EBAMAh** --- terpolymer of ethylene, butyl acrylate, and maleic anhydride
**EEAMAh** --- terpolymer of ethylene, ethyl acrylate, and maleic anhydride
**EMAMAh** --- terpolymer of ethylene, methyl acrylate, and maleic anhydride
**NOTE**: there are various other terpolymers in the industry for specialized applications

**Grafted Resins:**
**EVA-gMAh** --- ethylene vinyl acetate with a graft of maleic anhydride
**LLDPE-gMAh** --- LLDPE with a graft of maleic anhydride
**HDPE-gMAh** --- HDPE with a graft of maleic anhydride
**PP-gMAh** --- polypropylene with a graft of maleic anhydride
**NOTE**: there are various other grafted resins in the industry for specialized applications

**Others:**
**Peel Seal or Easy Peel** --- generic name for a peelable sealant resin of unknown brand / grade.
** if brand is known, please indicate, such as Dow Appeel™, MDP(Japan) CMPS™, Yasuhara Hirodyne™, Tosoh Melthene®
**H.S. lacquer** --- generic name for a 'heat seal lacquer', usually applied by gravure.
**Hot Melt** --- generic name for a hot melt adhesive applied as a sealant.

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**Structure Examples:**
***** Structures should be written from "outside to inside", with regards to the order of layers, starting from the left.**

**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.

**OPET / 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.

**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.

**15u BONy / ink / PUR adh // 88u LDPE**
*** an adhesive lamination of an LDPE film to a reverse printed biax nylon film. The PUR adhesive is applied to the reverse printed nylon film**.**

**0.5 mils OPET-PVdC / ink / primer / 0.8 mils LDPE / 1.5 mils Peel Seal**
*** a 0.5mils OPET film with PVdC coating is reverse printed on the PVdC side. The printed side is then primed and extrusion coated with 0.8 mils LDPE. A 1.5 mils extrusion coating of a peelable sealant resin is applied onto the LDPE. This is done in either via tandem or a two-pass extrusion coating, not specified.

**12u OPET / primer / 15u LDPE / 6u alu / ( 11u EMAA – 25u Peel Seal )**
*** a 12 micron OPET film is primed and extrusion laminated with 15 microns of LDPE to 6 micron aluminum foil. The bare aluminum side is then coextrusion coated with a two-layer coating comprising 11 microns of EMAA and 25 microns of a peelable sealant resin.

**OPET / primer / LDPE / sealant // TL // leather**
*** an oriented polyester film that is primed and extrusion coated with LDPE and then a sealant resin. This structure is then thermally laminated to leather. ( The application may be for an emblem or other fabric decoration that requires surface protection. )

**Ink / 30u alu < flame / ( EMAA – Peel Seal )**
*** a surface printed aluminum foil that is in-line flame treated, and then coextrusion coated with an EMAA copolymer and a peelable sealant resin. ( A cup or tray type lidding application. )

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

**20u OPP / ink / adhesive // 7u alu / 33 gsm EAA**
*** a 20 micron OPP film is reverse printed, then adhesively laminated to 7 micron aluminum foil. The adhesive is applied to the printed surface, not the aluminum. The laminate is then extrusion coated with 33 grams per square meter of EAA.

**20u OPP-PVdC / low temp PUR primer / 35u 18% EVA**
*** PVdC coated OPP is extrusion coated with an 18% EVA.
A special low activation temperature PUR primer is used to allow for direct extrusion coating of an EVA at 235°C onto a primed film. (235°C is the upper limit for EVA extrusion temperature.)

**BONy / ink / solventless adh // ( LLDPE – LDPE – ionomer )**
*** a solventless adhesive lamination of a reverse printed biaxially oriented nylon film, to a three layer coextruded film. The adhesive is applied to the printed surface of the nylon film.

**OPP < corona / solvent adhesive // ( Nylon 6 – tie – LDPE – ionomer )**
*** an OPP film that is corona treated in-line, then has a solventless adhesive applied to its surface. This film is then combined with a four layer coex film, usually with a heated pressure nip.

**O.L. / ink / 40# Paper < flame / 0.7 mils LDPE / 0.35 mils alu / 1.8 mils ionomer**
*** a surface printed and overlacquered 40 pound paper is flame treated, and extrusion laminated using LDPE to aluminum foil. The other side of the alu is then extrusion coated with the ionomer. You will need to specify if this is done in a two-pass operation on a single station extrusion coating line, or one pass on a tandem extrusion coating line.

**O.L. / ink / Paper / EMAA / alu / [ionomer + Slip MB]**
*** a surface printed and overlacquered paper is extrusion laminated to alu foil with EMAA. The other side of the alu is then extrusion coated with a blend of ionomer and masterbatch.

**OPET / ink /adh // SiOx-OPET / primer / ( LDPE – ionomer )**
*** a reverse printed OPET is adhesively laminated to a silicon oxide coated OPET. The adhesive is applied to the printed surface of the outer OPET. Then the plain side of the silicon oxide coated OPET is primed and coextrusion coated with a two-layer coating of LDPE and ionomer.

**OPET / ink / primer / met / adhesive // ( Nylon - tie - LLDPE )**
*** a reverse printed OPET is primed on the ink surface, then metallized. This film is then adhesively laminated to a three-layer coex film. The adhesive is applied to the metallized surface.

**OPET / ink / adhesive // OPET-VM / ( LDPE – ionomer )**
*** a reverse printed OPET is adhesively laminated to a metallized OPET. The adhesive is applied to the ink surface. The metallized layer is facing to the inside of the package structure, not the outside. The metallized surface is coextrusion coated with a two-layer coating of LDPE and ionomer.

**OPP / ink / primer / LDPE / primer / VM-CPP**
*** a reverse printed OPP that is extrusion laminated using LDPE to a metallized cast polypropylene film. Primers are applied to both the printed OPP, and the metallized CPP.

**OPET / ink / primer / LDPE / VM-OPET // adhesive / CPP**
*** a reverse printed OPP that is extrusion laminated using LDPE to a metallized OPET. This is then adhesively laminated to a cast polypropylene film. The adhesive is applied to the CPP film.

**OPET / ink / primer / LDPE / VM-OPET / adhesive // CPP**
*** a reverse printed OPP that is extrusion laminated using LDPE to a metallized OPET. This is then adhesively laminated to a cast polypropylene film. The adhesive is applied to the OPET film.

**12u OPET-met / adh // 15u BONy / adhesive // corona > ( 20u LLDPE – 10u LDPE – 45u EVA )**
*** an OPET that has been metallized, then adhesively laminated to BONy film. The other side of the nylon film is then adhesively laminated to a coex film which has been in-line corona treated (likely re-treated to burn off slip agents in the film).

**OPET / ink / primer / LDPE / met-OPET < corona / (tie – LDPE) / LLDPE film**
*** a reverse printed OPET film that is coated with an unknown primer, and then extrusion laminated to metallized PET film using an LDPE. The plain side of the PET film is then extrusion laminated to LLDPE film using a special tie resin and LDPE in a coextrusion process.

**20u OPP / ink / primer / 15u LDPE / 13u met-OPET < corona / (6u tie - 6u LDPE) / 12u ionomer**
*** a reverse printed OPP that is extrusion laminated to a metallized PET film. The plain side of the PET film is coextrusion coated with a tie resin and LDPE, and the LDPE is extrusion coated with ionomer.

**( 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. (A toothpaste tube laminate type application.)

**Cello / ink / primer / LDPE / alu / EMAA**
*** cellophane that is reverse printed, primed, and extrusion laminated to aluminum with LDPE. The other side of the alu is then extrusion coated with EMAA.

**K-Cello / ink / primer / LDPE / alu / ionomer**
*** a PVdC coated cellophane (two side coated), that is reverse printed, primed, and extrusion laminated to alu with LDPE. The other side of the alu is then extrusion coated with an ionomer.

**O.L. / Ink / 50gsm Paper / LDPE / 7u Alu / 35u EAA**
**Note: (made by tandem extrusion line)**
*** 50 gsm Paper that is surface printed and overlacquered. It is extrusion laminated with LDPE to alu. The other side of the alu is extrusion coated with EAA. This is specified as being processed by tandem extrusion lamination instead of two-pass coating.

**LDPE / ink / 18 pt. Board / LDPE / alu / (EAA- 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 LDPE and EAA**.**

**50u Blue EAA //TL// alu //TL// 50u EAA**
*** a thermal lamination of blue pigmented EAA film to alu on one side. Another film of clear EAA is thermally laminated to the other side of the alu. (A cable shielding laminate type structure.)

**Green EAA / 200u alu / EAA**
*** an extrusion coating of green pigmented EAA is applied to one side of the 200u alu. A clear EAA is extrusion coated to the other side of the alu. (A cable shielding laminate type structure.)

**( LDPE – EAA ) //TL// 150u alu //TL// ( EAA – LDPE )**
*** 150u aluminum that has coex films thermally laminated to each side. (A cable shielding type structure.)

**{ ( mLLDPE – LDPE – tie – Nylon – EVOH – Nylon – EVA tie ) //BL// ( EVA tie – Nylon – EVOH – Nylon – tie – LDPE – mLLDPE ) }**
*** a thirteen layer structure that is made by intentionally blocking a coex blown film in the main collapsing nip. The film from the die is actually seven layers. In the main nip, the bubble is blocked on purpose. The nip rolls may be heated to help this. The tower height is usually very short so that the film is still quite warm entering the nips. The tie resin at the blocking interface is known to be an EVA based tie resin, but the exact grade of brand is not known.

**( Nylon 6,6 – Tie A – Nylon 6 – Tie B – ionomer )**
*** a five layer coextruded film. You will need to specify if this is made by a cast film or blown film process. In a straight coextrusion, this is helpful to know for physical property issues.

**( PP – tie A – Nylon 6 – EVOH – Nylon 6 – tie B – LLDPE )**
*** 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**.**

**( Nylon – tie – Nylon – tie – LLDPE – 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 LLDPE. An upgrade would be to specify grade or density of the

mPE and the grade or ion type of the ionomer. You will need to specify whether it is made by a cast film or blown film process.

**( 15u Nylon 6 – 5u LLDPE tie – 45u LLDPE )**
*** a three layer coextruded film. Thickness of each layer is known, so is specified in the structure. The tie resin grade is not known, but it is known that is based on LLDPE. You will need to specify whether it is a cast film or blown film.

**( 20u [Nylon 6 + Amorphous PA] – 4u tie – 40u LLDPE )**
*** a three layer coex film. The blend ratio of the outer layer is unknown. The layer thickness for each layer is specified. You will have to specify if this is made by a blown or cast film process.

**( [ 80% Nylon 6 + 20% Amorphous PA ] – tie – EVOH – tie – LLDPE )**
*** a five layer coextruded film. The outer layer is a blend of 80% Nylon 6 plus 20% amorphous nylon. You will need to specify if the film is made by a blown or cast process.

**( 850u HDPE – 55u HDPE tie – 55u Nylon 6 )**
*** a three-layer coextrusion, which by looking at the thickness, likely is a coex blow molded bottle. This type of layer thickness is often used for barrier bottles, such as for agricultural chemicals, where nylon is often used as the inner layer. Please indicate the application when drafting out structures such as this to prevent confusion, as this could also be a sheeting application.

**( 725u HDPE – 12u regrind – 55u HDPE tie – 55u Nylon 6 )**
*** similar to above structure for an agchem bottle, except with a layer of regrind material between the outer HDPE and the tie layer.

**( 225u PP – PP tie – 35u EVOH – PP tie – 175u PP )**
*** a coextrusion that by the thickness is likely a sheet material. The type of structure may seem to indicate that it might be used to thermoform into some type of cup or tray. A description of the actual application for the structure should be included in any communication.

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***Sample structures for practice descriptions:***

**K-Nylon < corona / adhesive // ( mLLDPE – 12% EVA – peel seal resin)**
**BONy-PVdC / adhesive // ( mLLDPE – mLLDPE – EMAA )**
**BONy-PVdC / primer / ( LDPE – LDPE – EMAA )**
**OPET / ink / adh / alu / adhesive // ( LLDPE – LLDPE – EMAA )**
**PET-VM / adhesive // BONy / adhesive // corona > ( LLDPE - LDPE - EVA)**
**OPP / ink / adh // met-OPET / primer / ( LDPE – ionomer )**
**OPET-PVdC /ink / adhesive / ( LDPE – EMAA – ionomer )**
**PVdC-OPET-PVdC / ink / adhesive / LLDPE**
**Woven PP < corona / ( tie – LDPE ) / LLDPE film**
**Woven PP < corona / ( tie – CoPP )**
**OPP / ink < corona / ( tie – [ LDPE + EMAA ] / met-OPET / primer / ozone > ( LDPE – EVA )**

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The following references for Companies & Trademarks are as of June 2021. Please note that companies change names and business are sold and acquired, and in the future the owner of a given trademarks may shift. Please consult current literature when wanting to reference a trademark of a material.

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**Trademark References:**

**Advansix:** Aegis®

**Amcor:** EZ Peel™, Reseal™

**Arkema:** Pebax®, Orgalloy®, Kynar®

**BASF:** Ultramid®

**BerryGlobal:** Reemay®, Typar®

**Celanese Corp:** Ateva®

**ChevronPhillips Chemical**: Marlex®

**Dow Chemical:** Dowlex™, Elite™, Affinity™, Agility™, Engage™, Infuse™, Attane™, Versify™, Adcote™, Appeel™, Biomax™, Booster™, Bynel™, Conpol™, Elvaloy™, Elvax™, Entira™, Fusabond™, Nucrel™, Surlyn™

**DSM:** Akulon®

**DuPont-Teijin Films**: Mylar®, Melinex®

**DuPont:** Hytrel®, Selar®, Sorona®, Tyvek®, Zytel®

**EMS Group:** Grivory®, Grilon®

**ExxonMobil Chemical:** Escor™, Exact™, Exceed™, Escorene™, Optema™, Enable™, Exxco™, VistaMaxx™, Vistalon™

**Henkel**: Liofol®, Tycel®, Loctite®

**Ineos:** Eltex®, Rigidex®

**Ineos Styrolution:** K-Resin®, Styrofex®, Styrolux®, Terluran®

**Kuraray:** Eval™, Plantic™

**LyondellBasell Chemical**: Ultrathene®, Petrothene®, Microthene®, Plexar®, Toppyl®, Alathon®, Lupolen®, Hostalen®, Moplen®, Clyrell™, Adsyl®, Adstif™, Pro-Fax®, StarFlex®

**Mica Corp**: MICA™

**Michelman Corp**: Michem®

**Mitsubishi Chemical**: Modic™

**Mitsui Chemical:** Apel™, Admer™, Evolue™, Tafmer™, TPX™, Tafnel™

**Mitsui-Dow Polymers (Japan)**: CMPS™, Evaflex™, Hi-Milan™

**Nippon Gohsei**: Soarnol™

**Nova Chemical**: Novapol®, Sclair®, Surpass®

**Reliance Industries Ltd**: Relene™, Repol™

**SK Chemical**: Yuclair™, Primacor™, Saran™, Evatane®, Lotader®, Lotryl®, Lotryl® BestPeel, Orevac®

**Solvay**: Ixan®, Diofan®

**Topas Advanced Polymers**: Topas®

**Tosoh:** Melthene®, Nipoflex®,

**Toyo Chemical**: Oribain™, Tocryl™

**Versalis** (Eni SpA): Clearflex®, Flexirene®, Eraclene®

**Westlake Chemical**: EMAC®, EBAC®, Mxsten®, Tymax®, Hifor®, Elevate®, Epolene®

**Yasuhara Chemical**: Hirodine™, Hirotac™