meetingPACK 2017

3rd EDITION

Adhesión en envase barrera multicapa

Adhesion in Multilayer Barrier Packaging

Ofer Klein
(POLYRAM PLASTIC INDUSTRIES)

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Bondyram®

Polyram Group

Adhesion in Multilayer Barrier Packaging

Worldwide
smart solution

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May 2017

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Adhesion in Multilayer Barrier Packaging

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OUTLINE:

- About Polyram
- Bondyram® Tie Layers
  - Chemistry
  - Mode of Action
- Process Technologies
- Applications
- Typical Tie resins for multilayer applications

Bondyram®

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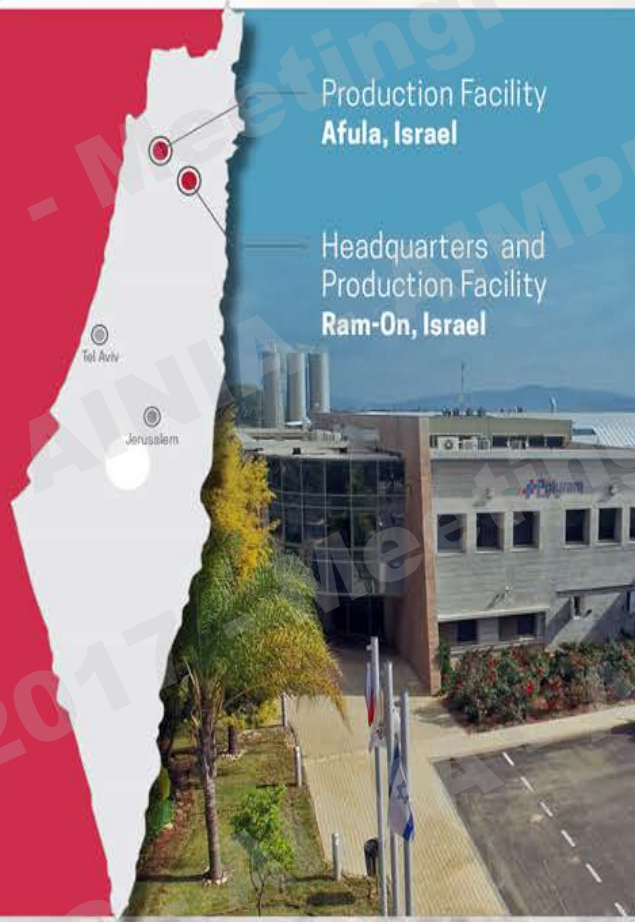
Polyram Plastic Industries LTD

- Established in 1986.
- 200 employees.
- Head office, main plant and R&D center located in the Northern part of Israel in Ram-On.
- Polyram operates three production sites : Ram-On & Afula in Israel, Tianjin in China and a new site under construction in the USA.
- 2004-2015 - Traded on the Tel Aviv stock exchange.
- 2015- Purchased by a private equity: "FIMI"



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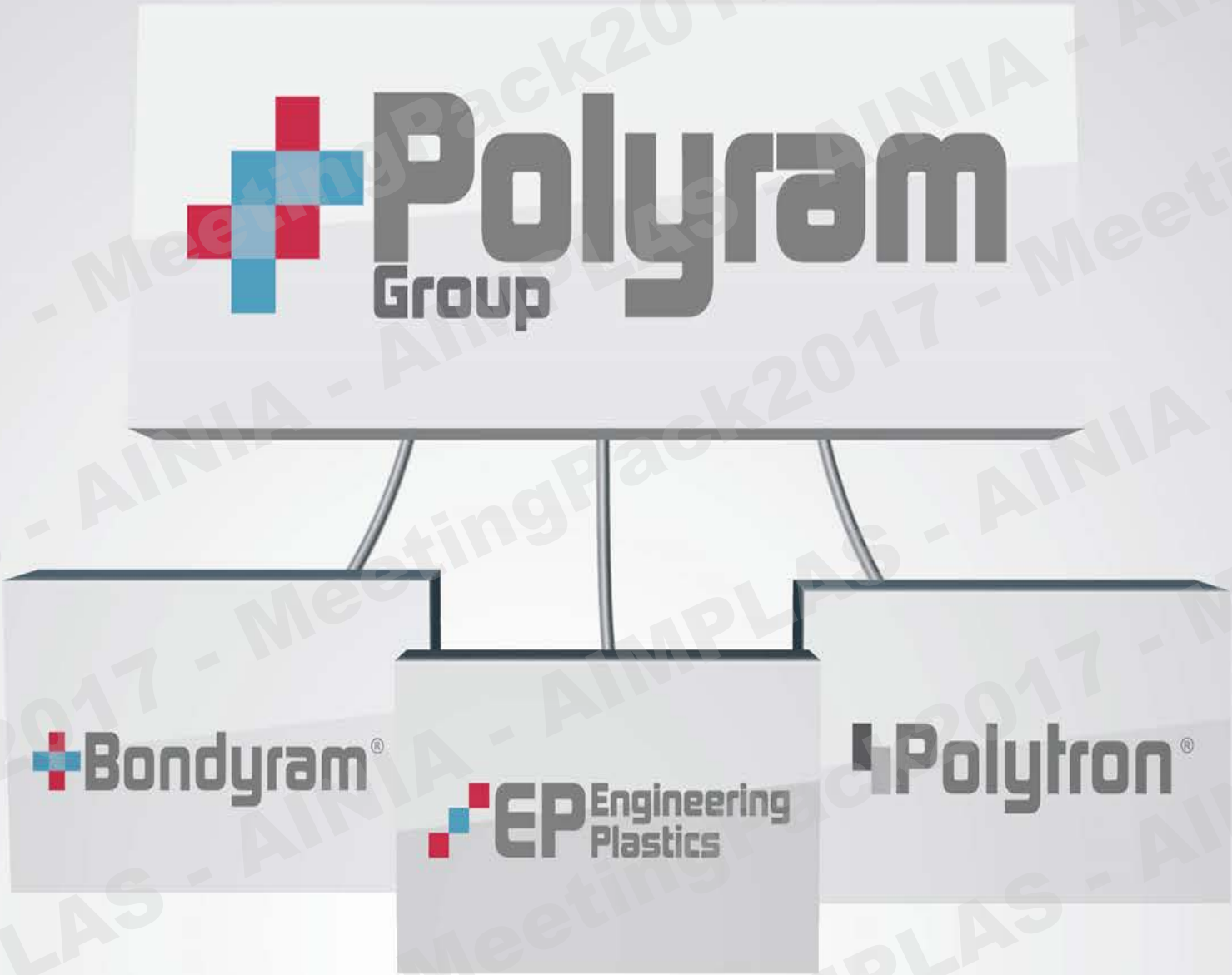

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Bondyram® TL

ADHESIVE RESINS

- Food Packaging
- Pharmaceutical & Cosmetic Products
- Chemical Packaging
- Construction

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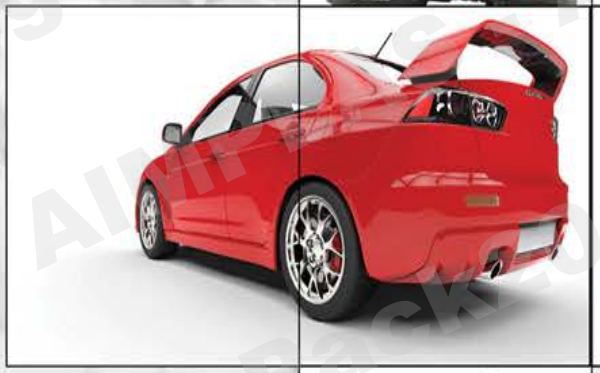
Functional Polymers

- Coupling Agents
- Compatibilizers
- Impact Modifiers



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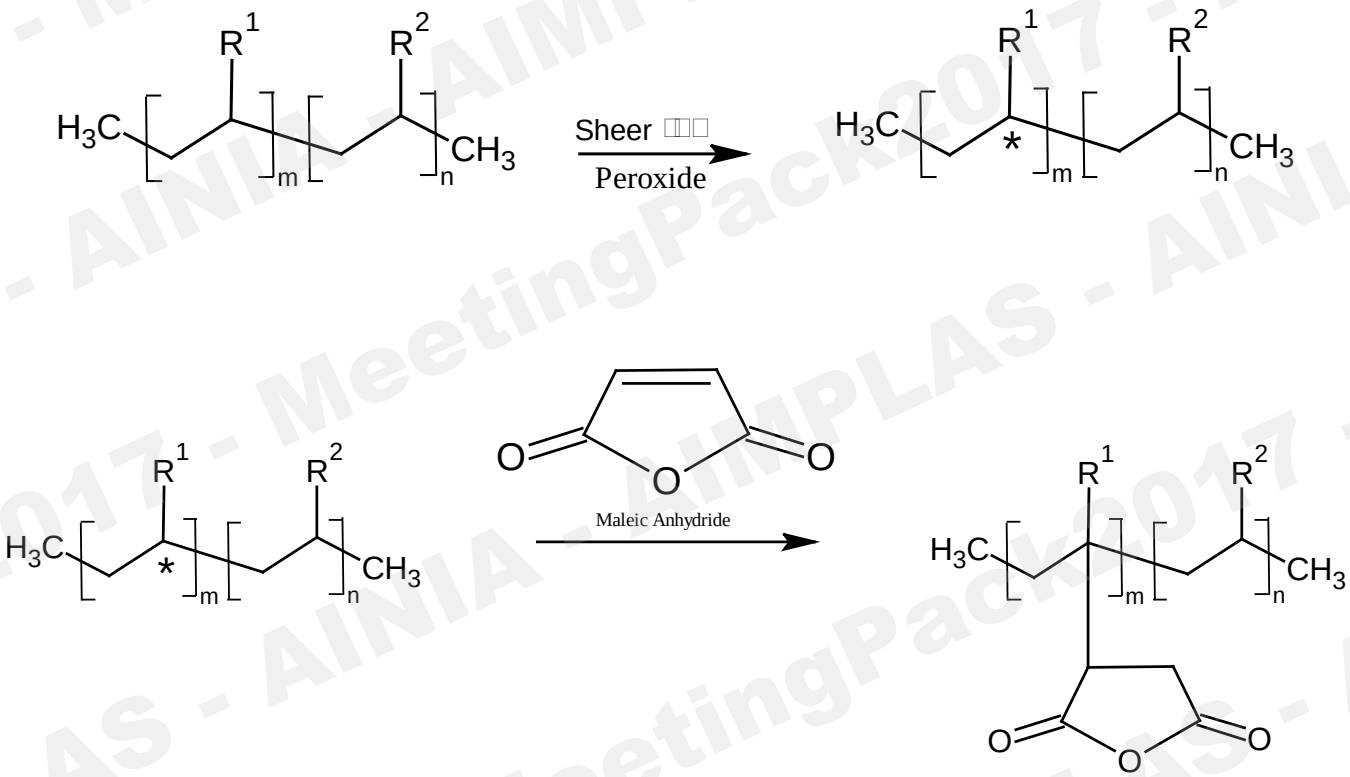
Maleic Anhydride Grafting Process



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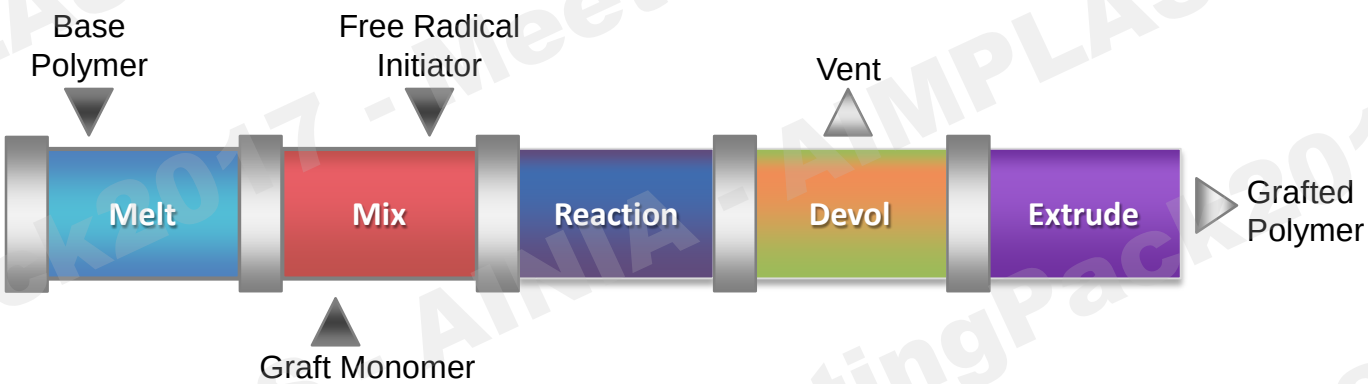
Maleic Anhydride Grafting Process

- The Bondyram® division operates 8 reactive extrusion lines (twin screw co-rotating).
- Total capacity of 30,000T/Y.



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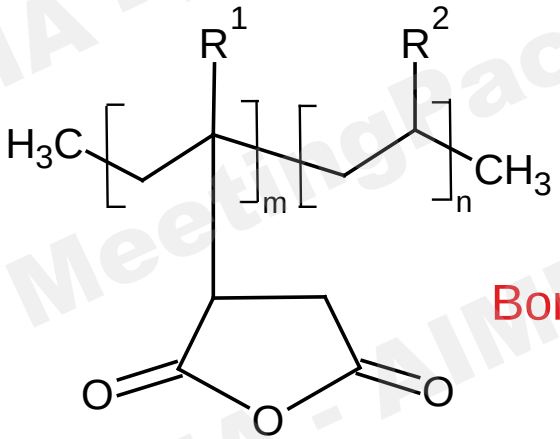
Bondyram® Tie Layers

compatible with polyolefins



Bondyram®

can react with functional groups such as OH or NH2 (EVOH, PA)

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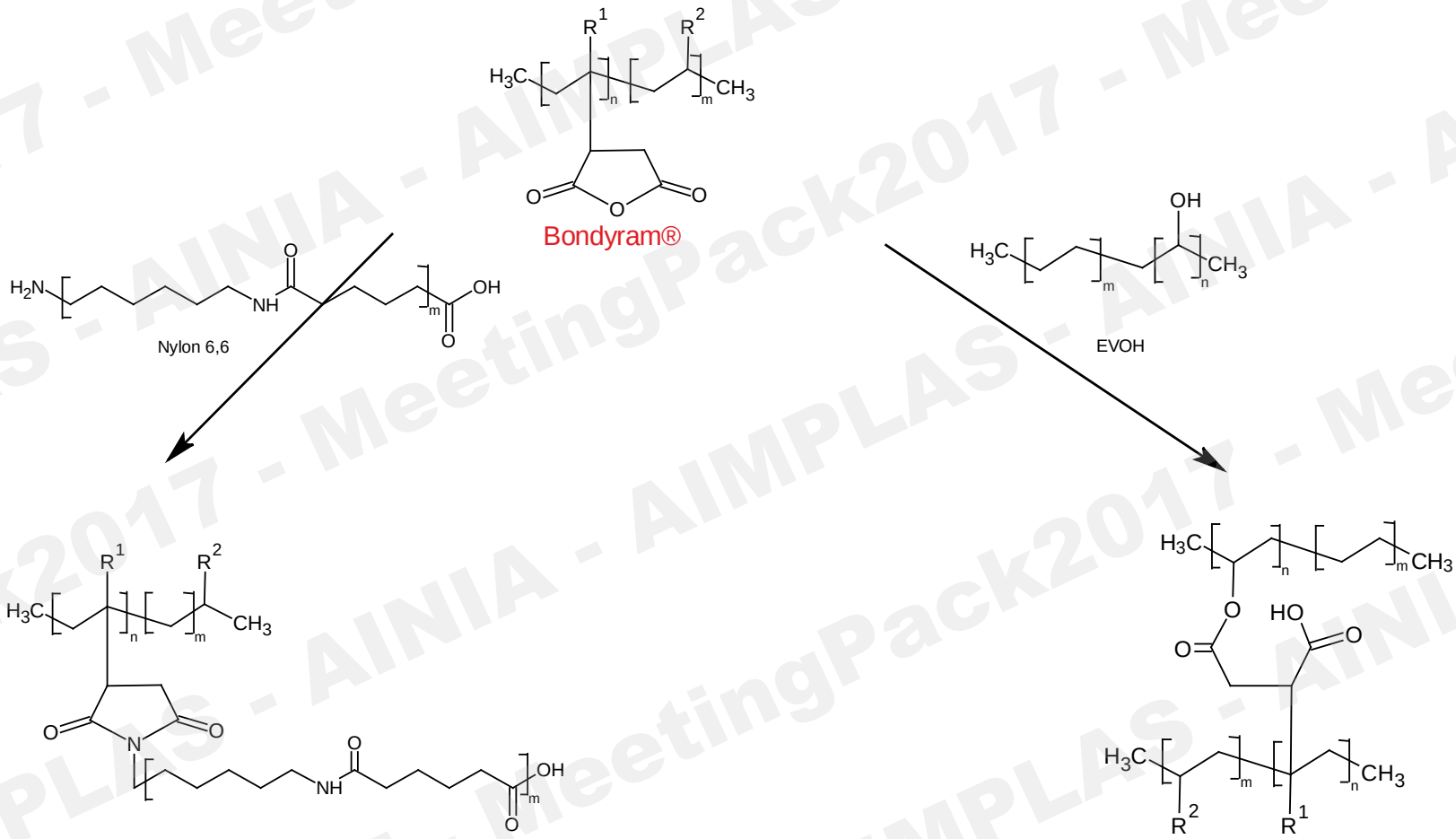
Adhesion in Multilayer Barrier Packaging

Adhesion via interfacial chemical bonding



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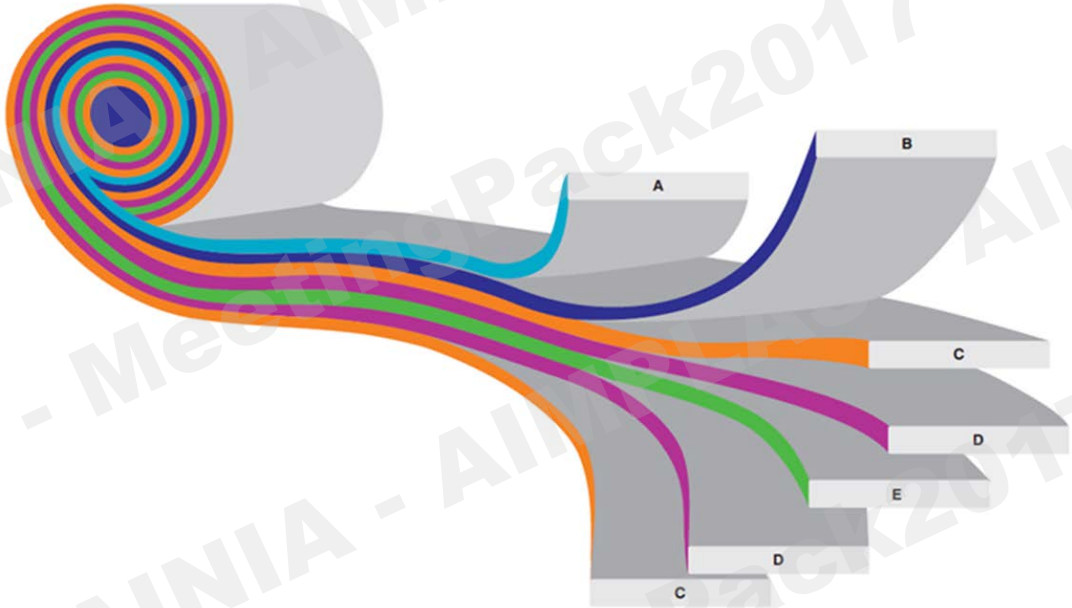
Tie Resins



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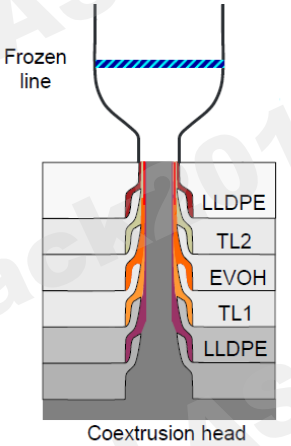
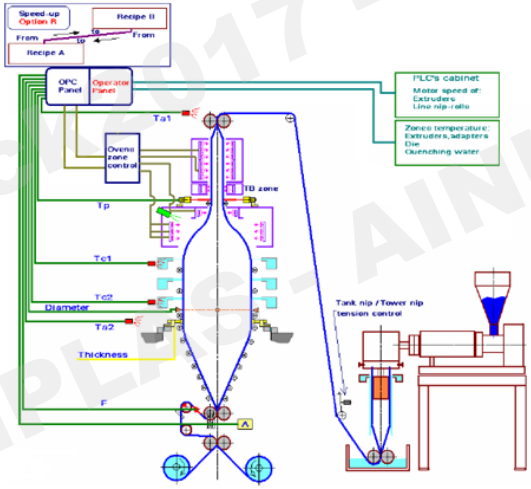
Co-Ex Blown Technology





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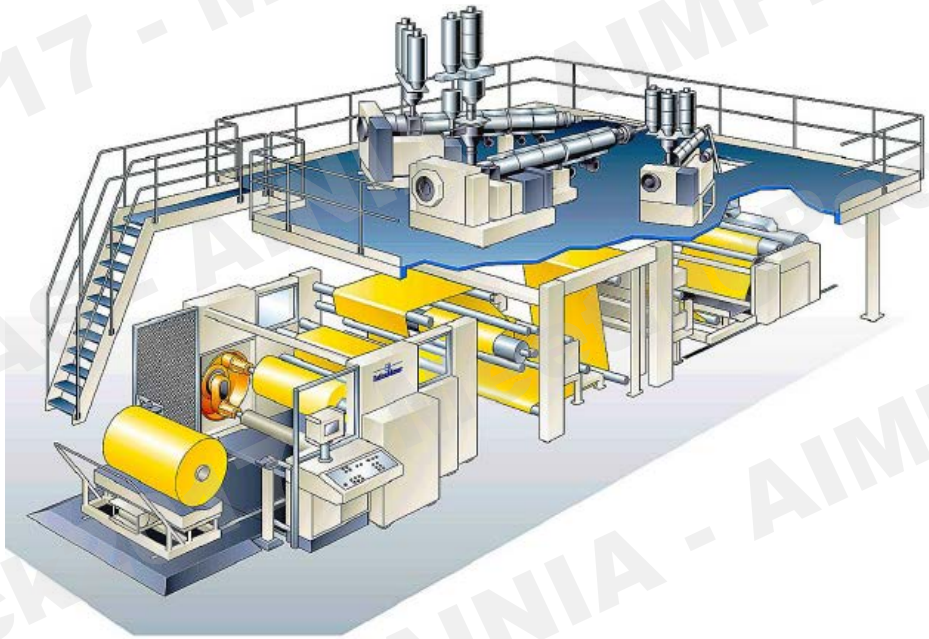
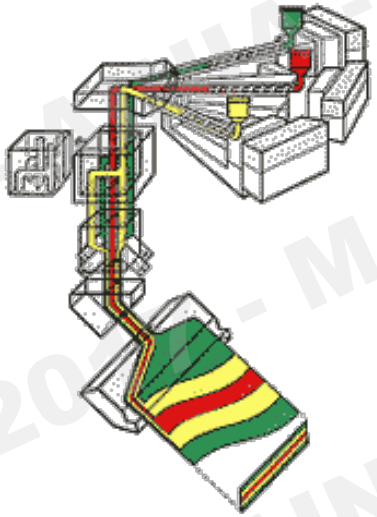
Cast Technology





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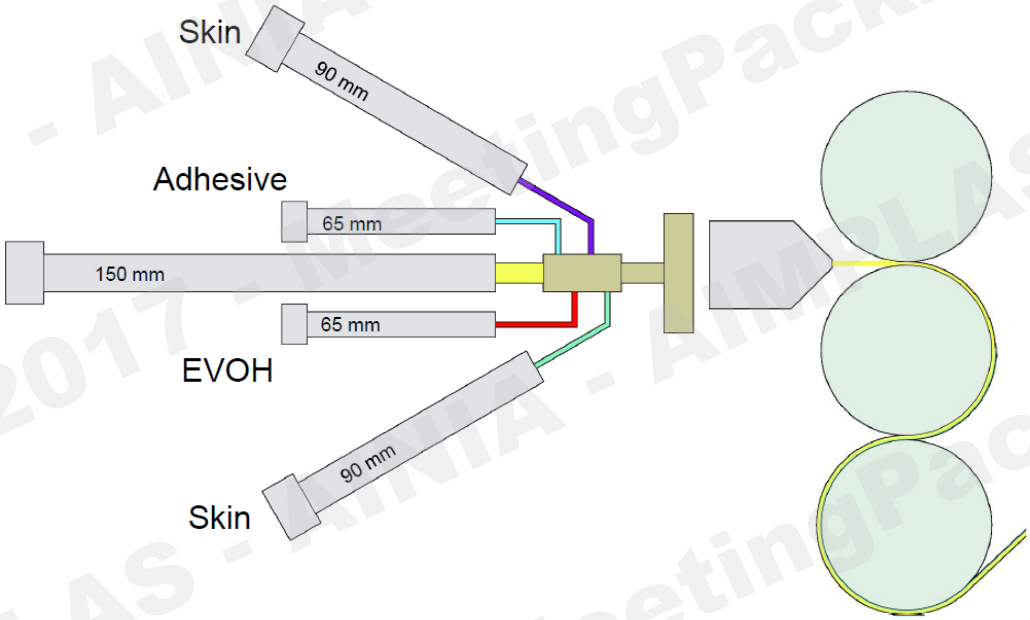
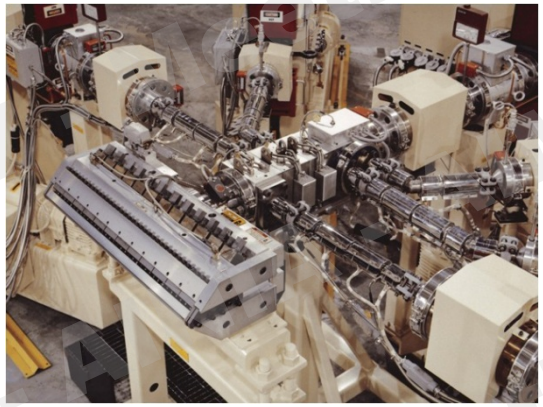
Sheet Multilayer Co-Extrusion





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Other Processes

- Blow Molding
- Multilayer Injection

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Tie Layers used in multilayer food packaging applications

Lid for chilled food Packaging

Meat Products, Retort Sleeve

Film for packaging in VACUUM (PA/PE)

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Tie Layers used in multilayer food packaging applications

Multilayer sheet in thermoforming
(PP/Tie/EVOH/Tie/PP)
(PS/Tie/EVOH/Tie/PE)

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Tie Layers used in Blow Molding applications

Multilayer Bottles in blow molding
(PP/Tie/EVOH/Tie/PP)
(HDPE/Tie/EVOH/Tie/HDPE)

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Tie Layers used in Blow Molding applications

Multilayer containers in Multilayer Injection
(PP+Tie/EVOH/Tie+PP)

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Adhesion in Multilayer Barrier Packaging

Product Groups

- Polyethylene Based
  - Ready to Use
  - Concentrate
- Polypropylene Based
- Polystyrene
- EVA
- PET

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Adhesion in Multilayer Barrier Packaging

Ready to Use PE Bondyram® TL

Typical Property Data

Property	Unit	Test Method	Bondyram® Grade A	Bondyram® Grade B	Bondyram® Grade C	Bondyram® Grade D
MFI (190°C/2.16kg)	g/10min	ISO 1133	4	3	1.7	6-7
Density	g/cm^3	ISO 1183	0.929	0.93	0.92	0.91
Melting Point	°C/°F	ISO 3146	127/261	127/261	121/250	114/237
VICAT Softening Point	°C/°F	D-1525	101 / 214		92 / 198	
Base Resin			HDPE	LLDPE/MDPE	LLDPE	LLDPE

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Adhesion in Multilayer Barrier Packaging

Concentrated PE Bondyram® TL

- Bondyram PE concentrated products can be diluted with any Polyethylene of any density.
- Material is easily dry blended
- Please pay attention the total flow will fit the application.
- Please make sure the diluant PE will be free from migrate additives such as slip agents , anti block and anti fog.

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Adhesion in Multilayer Barrier Packaging

Concentrated PE Bondyram® TL

Typical Property Data

Property	Unit	Test Method	Bondyram® Grade A	Bondyram® Grade B	Bondyram® Grade C	Bondyram® Grade D
MFI (190°C/2.16kg)	g/10min	ISO 1133	2	1.5	1.8	2.5
Density	g/cm^3	ISO 1183	0.905	0.918	0.905	0.905
Melting Point	°C/°F	ISO 3146	117/243	122/252	117/243	117/243
VICAT Softening Point	°C/°F	D-1525	185/ 85	210/ 98	185/ 85	185/ 85
Shore Hardness	D-Scale	D2240	40	45	40	40
Maleic Anhydride	%	FTIR	Med./High	High	Very High	Very High

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Concentrated PE Bondyram® TL

Formulation Type	EVOH/PE	EVOH/PE	PA/PE	PA/PE
Thickness (µm)	<50	>50	<50	>50
Ratio Recommendation	1:2	1:3	1:4	1:5
Bondyram® in formula	33%	25%	20%	17%

- Polyamide Is easier to Bond then EVOH
- Thick film is easier to bond then thin film
- Blown film is easier to bond then Cast film

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Adhesion in Multilayer Barrier Packaging

Benefits of Concentrated PE Bondyram® TL

- Cost reduction
- Low inventory
- Adjust formulation and properties demand
- Confidential formulation IP

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Adhesion in Multilayer Barrier Packaging

PP Bondyram® TL

Typical Property Data

Property	Unit	Test Method	Bondyram® Grade A	Bondyram® Grade B	Bondyram® Grade C	Bondyram® Grade D
MFI (230°C/2.16kg)	g/10min	ISO 1133	4	3.5	7	4.5
Density	g/cm^3	ISO 1183	0.90	0.90	0.90	0.90
Melting Point	°C/°F	ISO 3146	146/295	153/307	153/307	167/333
VICAT Softening Point	°C/°F	D-1525	97/207	126/259	126/259	132 /270
base Resin			rPP	rPP	rPP	cPP

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Adhesion in Multilayer Barrier Packaging

PS Bondyram® TL

- Applications such as:
  - ✓ co extrusion of multi-layer sheets with the following structures
  - ✓ PS/TL/EVOH/TL/PE, PS/TL/EVOH/TL/PS
  - ✓ designed especially for polystyrene application involving hot fill

- The material is suitable for blown and calendaring process technologies

- The material can be used for food packaging where a barrier layer is needed, such as tomato paste, apple puree, coffee capsules etc.

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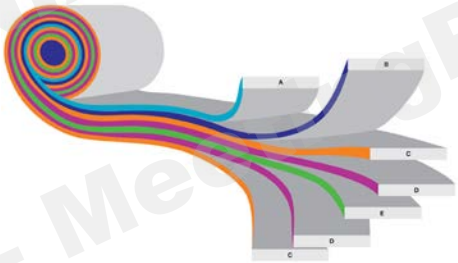
Adhesion in Multilayer Barrier Packaging

PS Bondyram® TL

Typical Property Data

Property	Unit	Test Method	Bondyram® Grade A	Bondyram® Grade B
MFI (190°C/2.16kg)	g/10min	ISO 1133	1.5	1.4
Density	g/cm^3	ISO 1183	0.940	0.950
Melting Point	°C/°F	ISO 3146	127/261	125/257
VICAT Softening Point	°C/°F	D-1525	89/ 192	83/ 181



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Adhesion in Multilayer Barrier Packaging

EVA Bondyram® TL

- Applications such as:
  - ✓ Co extrusion of multi-layer films & sheets with the following structure

    PS/TL/EVOH/TL/PE or PE/TL/EVOH/TL/PE

- The material is suitable for blown and calendaring process technologies

- The material can be used for food packaging or pharmaceutical applications where a barrier layer is needed

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Adhesion in Multilayer Barrier Packaging

EVA Bondyram® TL

Typical Property Data

Property	Unit	Test Method	Bondyram® Grade A	Bondyram® Grade B	Bondyram® Grade C	Bondyram® Grade D
MFI (190°C/2.16kg)	g/10min	ISO 1133	2	1.5	2	8
Density	g/cm^3	ISO 1183	0.950	0.940	0.95	0.95
Melting Point	°C/°F	ISO 3146	73/163	84/183	80/176	71/160
VICAT Softening Point	°C/°F	D-1525	45/ 113	63/ 145	47/ 117	44/ 111
TL			Concentrate	Ready to Use	Ready to Use	Ready to Use

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Adhesion in Multilayer Barrier Packaging

PET Bondyram® TL

- Designed for co extrusion of multi-layer films especially for adhesion of polyester (PET) to other polymers such as PE, PA, EVOH
- The material can be used for food packaging where a barrier layer and a polyester layer are needed
- The material is suitable for blown and cast process technologies

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Adhesion in Multilayer Barrier Packaging

PET Bondyram® TL

Typical Property Data

Property	Unit	Test Method	Bondyram® Grade A	Bondyram® Grade B	Bondyram® Grade C
MFI (190°C/2.16kg)	g/10min	ISO 1133	2	6	1.5
Density	g/cm^3	ISO 1183	0.9	0.9	0.92
Melting Point	°C/°F	ISO 3146	111/232	110/230	112/234
VICAT Softening Point	°C/°F	D-1525	53/ 127	53/ 127	85/ 185

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Additional Applications

- Agriculture films for soil fumigations (PE/PA)
- Automotive Fuel Tanks (HDPE/EVOH/HDPE)
- Multilayer Carton Bags

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Thank you

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