Heat seal lacquers -
how to meet today’s and tomorrow’s demands of the market

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Overview

1. Definition and basics
2. Applications
3. Example “Paper/mPET”
What is a heat seal lacquer

Heat seal:

Two substrates are linked, tied, combined by the mean of heat and at least some pressure. One or both substrates have a heat sealable layer (or are heat sealable by themselves), which is activated by heat.

Other methods to combine substrates:

• Cold seal / pressure sensitive tape: no heat is necessary, mainly pressure
• Adhesive lamination: both substrates are combined in-line

What is a heat seal lacquer

Heat seal lacquer:

The heat sealable layer is produced by lacquering, the liquid, diluted phase is transformed to a dry coating by evaporating the solvents

Other methods to produce heat sealable layer:

• Coextrusion of a special heat sealable layer during film processing
• Hot melt / extrusion coating: heat sealable layer is put on by heating up and subsequent coating on the substrate
What is a heat seal lacquer

Liquid coating, which is dried to become tack- and block- free, solidified, rewound and used later.

**Heat** activated to become soft and tacky.

**Pressed** to second substrate to make bond.

**Cooled** to room temperature to form bond between layers of substrates.

Typical heat seal process

During seal process the heat seal coating (in melted state) has to give a tie / link with the cup.

Heat seal coating has to adhere to lid- substrate.
Adhesion / Cohesion

In order to give the expected performance, the heat seal lacquer has to adhere to both substrates and needs cohesive strength:

Criteria for Heat Seal Lacquers / areas of development

- Drying conditions, what solvents may be used
- Sealability at what conditions, Seal strength
- Opening behaviour (destructive or peel)
- Some Criteria
  - seal partner
- What type of filling goods (product resistance)
- blocking resistance
- optical appearance (of lacquer and seal)
- hot tack
Criteria for Heat Seal Lacquers / areas of development

Example

Dairy packing should open “smoothly”, but still remain integer during transport!

Lid should not tear, there should be no rupture.

Opening behaviour (destructive or peel)

Seal Partners

PVC: Polyvinyl chloride
PS: Polystyrene
PP: Polypropylene
PE: Polyethylene
A-PET: Amorphous Polyethylene terephthalate

Typical uses:

PS and PP (“softer” than PS) and PE in combination with cardboard for dairy packaging;
PVC for pharmaceutical blister;
A-PET for diary packaging (transparent, barrier properties)
Basics of heat seal lacquer formulations (non-coloured)

Solvents:

• Low boiling: for example: ethyl acetate
• Medium boiling: for example: butyl acetate
• High boiling: for example: aromatic solvents

Resins:

• Thermoplastic resins to give sealability (see next slide)
• Resins to give adhesion to substrate
• Other resins for special performance

Basics of heat seal lacquer formulations

Thermoplastic resins to give sealability

• Vinlyic (PVC and PVDC based)
• Acrylate and styrene acrylate based
• Acrylate / Polyolefin
• Styrene (copolymer) based
• Polyester based
• PP- Dispersion
• EVA/EAA/EMAA
Basics of heat seal lacquer formulations

Additives:

- Waxes / Slip agents (for slip properties, release, antiblock, seal performance): Polyethylene wax, Carnauba wax, PTFE, Fatty acid ester
- Inorganic pigments / filler (for antiblock, for haptic/optical properties, for seal performance, for viscosity control): Silica, talc
- Antioxidants / UV-stabilizer / optical brighteners
- Antifoam (in water based products)
- Adhesion promoter: Epoxy resins for Aluminium substrates

Appearance / Stirring:

- Typically no stable solution
- Heat seal lacquers have to be stirred well before application

Heat seal lacquer with filler before (left) and after stirring (right)

Segregation / “dephasing” of a heat seal lacquer without filler
New developments:
Market pull / Technology push

**Market pull:**
- New requirements for existing packages (for example new food law regulations)
- New packages

**Technology push:**
- New products based on existing technologies / formulations
- New technologies

Some Applications

- Blister Foils for Pharmaceutical Products
- Lids for sterilizable Containers
- Composite Cans
- Lids for Food packages (especially dairy)
  * for Aluminium Foils
  * for PET- Films and Paper/PET
Blister Foils for Pharmaceutical Products

**Heat seal coating** based on PVC or PVC/Acrylate (sealable to PVC or PVDC- Blister)

**Universal Heat seal coating** (sealable to PP-Blister)

Lids for sterilizable Containers

**Heat seal coating** on epoxy resin basis sealable to PP

**Heat seal coating** PVC-based

*Lid: Aluminium foil with heat seal coating*

*Tray: Alu-PP laminate (deep drawn)*
Composite Cans

**Paper-/ Composite Cans**

Internal Protective-/ Heat seal coatings PVC and Polyester based

Paper / Aluminium foil laminate with heat seal coating
In this case folded, sealed lacquer to lacquer

Lids for Food packages

**Heat seal coating** based on PVC or PVC/Acrylate, sealable to PVC / PS / APET

**Universal Heat seal coating**

sealable to APET / PP / PVC / PS

**Heat seal coating** based on polyester, sealable to APET / PVC, or itself
Lids for Food packages

**Heat seal coating** on PET (1- or 2-layer), sealable to APET, PS, PP or Aluminium

Heat seal coating for salad packaging

White PET film with heat seal coating
PP tray

Lids for Food packages

Heat seal coating for Chocolate Cream, chocolates packaging

Printed mPET film with heat seal coating
APET tray

Heat seal coating applied on entire surface or “in pattern”
Paper/PET- Lid material for PS- Cups

Lid material paper/Polyester or paper/metallised PET as replacement for aluminium lids.

Example “Paper/mPET”

Classification:

- 2- layer (Primer and Heat seal coating) or 1- layer
- Low / medium / high seal
- PVC (chlorine) containing or free
2-layer system

Classic Construction:

- Overprint varnish
- Printing ink
- Primer
- Paper
- Adhesive
- Metallised
- Polyester
- Primer
- Heat seal coating

1-layer system

Heat seal without Primer = 1 layer
Adhesion on non-treated PET-side of the Paper/mPET-laminate, seals to PS Cups

- Overprint varnish
- Printing ink
- Primer
- Paper
- Adhesive
- Metallised
- Polyester
- Primer
- Heat seal coating
Some details

In a typical “Paper/mPET” single layer heat seal lacquer minimum two main components are included:

One component to give anchorage to the PET surface, typically also a polyester resin. (NC or PVC resin for example do not adhere.)

Second component which seals to PS (typically a resin based on acrylate and/or styrene copolymer).

Heat seal coating has to adhere to PET

Heat seal coating has to seal to PS

Paper/PET- Lid material for PS- Cups

2- layer

1- layer

PVC free

PVC containing

Low seal

Medium seal

High seal

Low seal

Medium seal

High seal
Quality characteristics

• Seal strength
• „Hot tack“ (seal strength immediately after sealing, in warm condition)
• Compliance with health standards
• Machinability
• Coating weight
• Price per kg and – most important - price per m² coated area

Some laboratory tests

Cup sealing and evaluation of the seal performance:
Some laboratory tests

Control of seal strength including „hot-tack“ measurement device:

- PET with Heat seal coating
- PS Stripe
- Force/distance diagram

Closing remarks

- Every day objects
- There is a lot of knowledge behind it
- Ongoing changes
- New developments by market pull and technology push
Thank you for your attention.