

Doresco® Engineered Polymers

For Holographic Hot Stamp Foil Applications

Doresco™ engineered polymers enhance the performance of coatings used in hot stamp foil (HSF) holographic packaging applications. They are part of a comprehensive line of additives developed by Lubrizol for the graphic arts and printing industry.

Lacquers

- High glass transition temperatures (Tg) impart thermal stability, improve durability during shaping operations.
- Hardness resulting in greater chip and mar resistance for films that will be embossed for special effects.
- High optical clarity
- High gloss
- Colour retention

Release Products

- Optimize film transfer
- Tape liners in pressure-sensitive adhesives
- Release liners for transfer printing

Description

Holographic Hot Stamping Foils are multilayer structures produced by subsequent coatings followed by high vacuum metallization and embossing on special grade PET. The structure consists of at least three different coatings each one with a function in the overall structure. The function of the release layer is to avoid or minimize adhesion to the substrate or carrier (PET in most cases). The technology used in this coating involves low melting point waxes like Carnauba, Montana or Paraffin. Some customers include release resins in order to get better film consistency and release uniformity.

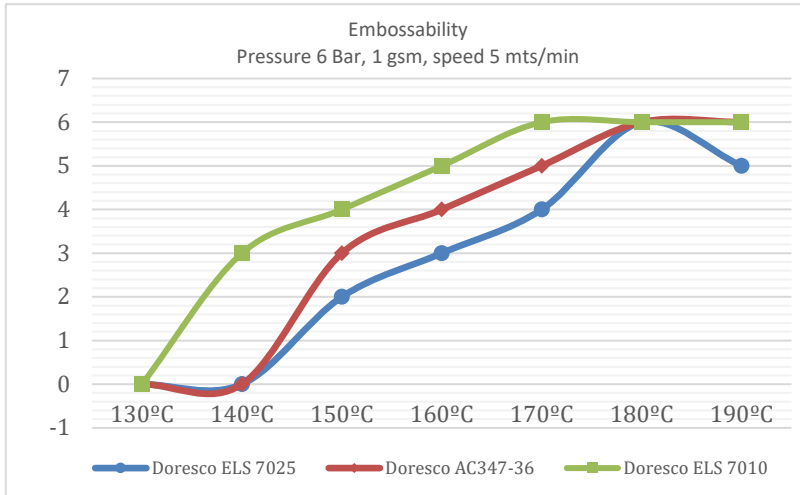
The embossing coating works as an aluminium receptive and embossable coating. It is one of the key components in the performance of the stamped foil. Embossing enables reproduction of the holographic effect.

The adhesive coating is responsible for achieving good adhesion on the desired substrate to be stamped and specially designed to achieve this adhesion on the desired substrates. These substrates vary from paper & board to Polypropylene & Nylon or PVC.

Technical Performance

Embossability

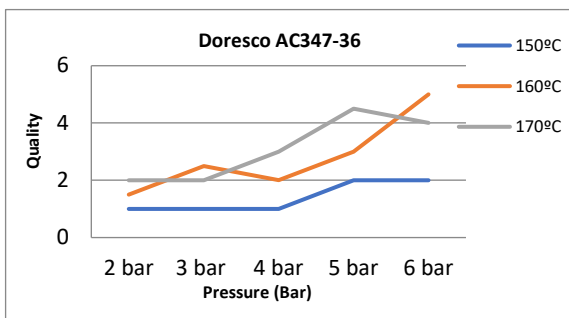
Embossable coatings are based on thermoplastic acrylics of very high Tg in order to impart the thermal stability needed in order to soften the coating but not melting it and provide excellent holographic reproduction. It is critical in its design to promote the softening of the coating without promoting stickiness that will cause the coating to stick to the holographic shim.



Temperature and pressure conditions have to be ensured in order to get the best holographic reproducibility. Doresco AC coatings are especially designed to ensure good holographic reproduction at higher embossing temperatures.

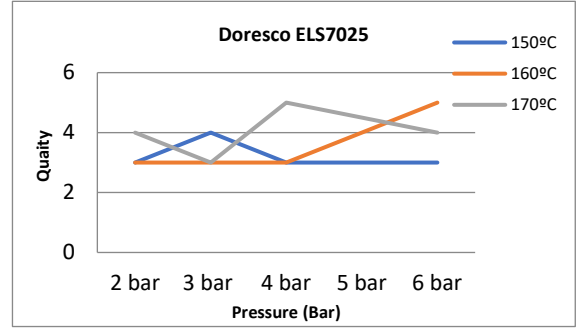
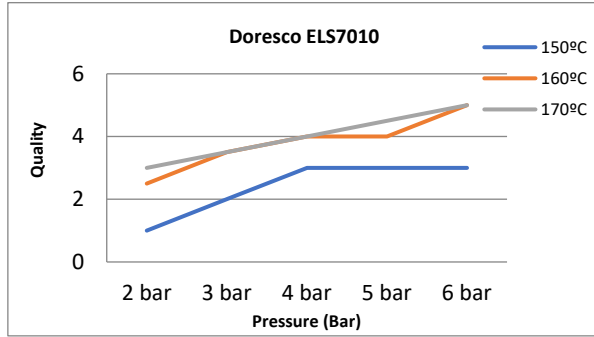
Normal coating weights are between 0.8 – 1.2 gr/sqm. Usual drying temperatures vary between 90°C and 150°C depending on the solvent used during dilution.

Embossable lacquers can be dyed with the recommended dyestuff at the recommended percentages depending on the solvent used and the solubility factors recommended by each manufacturer.

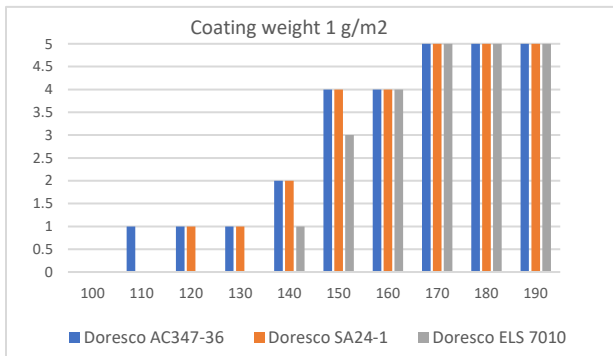


Embossability depends on several factors and press parameters need to be adapted depending on the product and the processing conditions. Two crucial parameters that needs to be carefully monitored are embossing temperature and pressure as from this the holographic sharpness will depend on. Embossing speed is also a factor that needs to be controlled but by playing with temperature and pressure speed differences might be modified for each press.

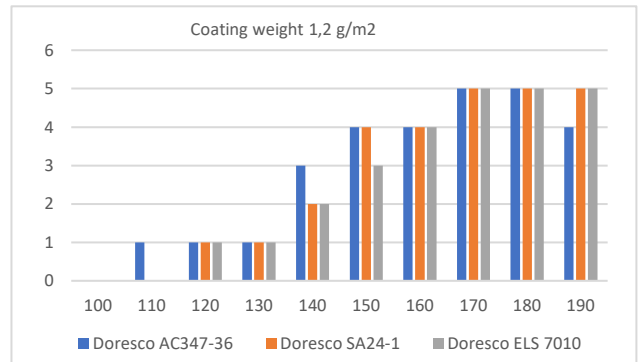
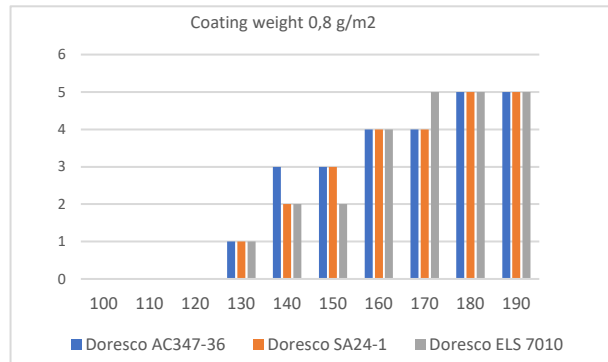
Each product will perform differently depending on the processing conditions used in the press. At a



given temperature Doresco AC products are designed to meet the customer specs as can be seen the graphs attached. Common embossing temperatures will give different performance depending on the product and the pressure applied.



Coating weight will also affect significantly the performance in terms of holographic reproduction. As said before, recommended coating for Doresco AC Line is approximately 1 gr/sqm. Variations on the recommended coating weight will give different performance. The flexibility and brittleness of the coating is directly affected by the thickness of such coating, and so, embossability will change as can be observed in the graphs below. Care must be taken on the cylinder wear and cells plugging as those could be the main factors that could lead to an inconsistent deposit.



Solvent selection for the dilution of the lacquer must be carefully controlled considering the following parameters:

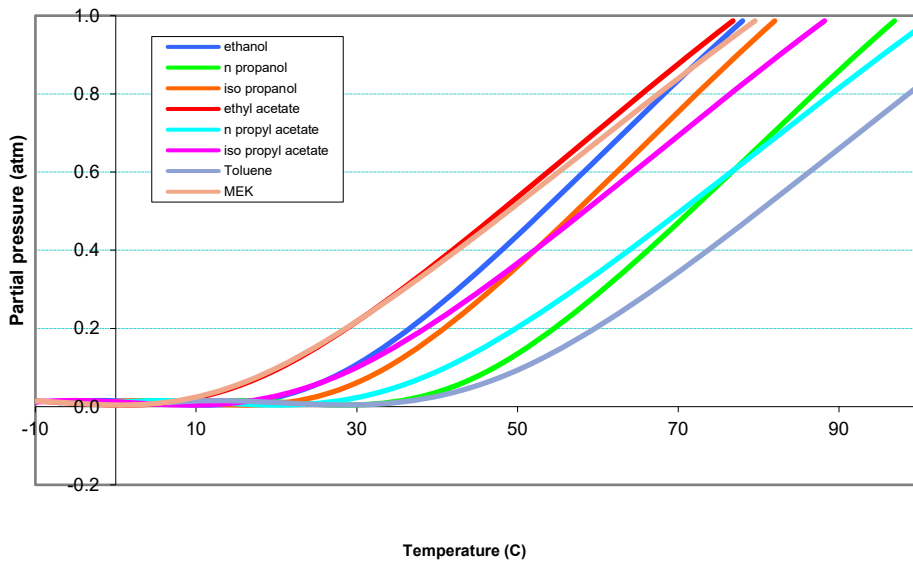
- Press speed
- Drying temperatures
- Solubility of the resin
- Dye solubility parameters (if coloured)
- Nature of the release lacquer used

A useful tool in terms of selecting the solvent blend to be used is the solvent partial evaporation rates which are shown in the table below for the main solvents used. The solvent selection must be chosen based on a

ladder % depending on the drying temperature on the web and the solubility of each solvent with the resin.

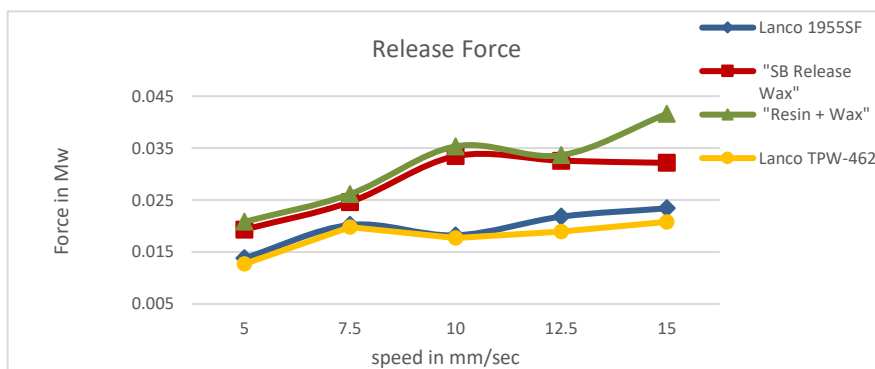
The solvents selected must not be very different in Solvent Partial Evaporation rates as that could give a richest blend of slow solvent during the evaporation process that may cause some incompatibility issues with the resin. Is sometimes better to choose a three solvents blend which will have closer solvent evaporation rates than two solvents with evaporation rates far different from each other, this will give a

Solvent partial pressures



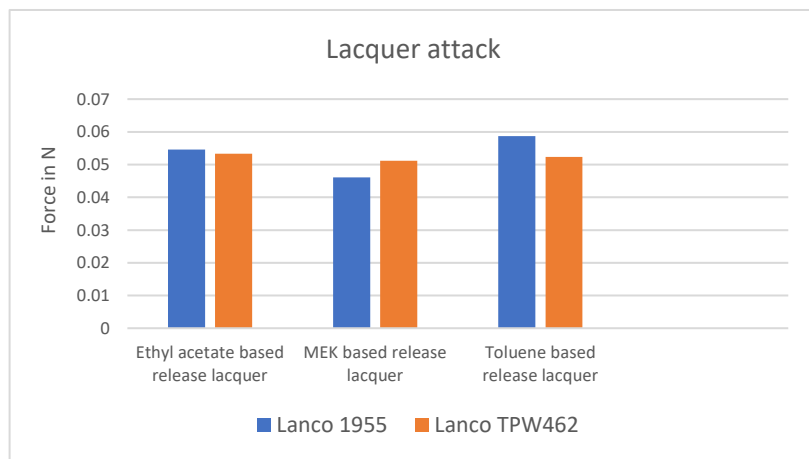
smooth evaporation on press and decrease the solvent retention values that may affect subsequent steps in the production of the holographic foil. A high level of retained solvent in the coating may affect the performance during embossing. Too high levels will cause the lacquer to stick to the shim. This could be managed by changing the parameters on the embossing machine for temperature and pressure, but ideally the solvent retained in the substrate should be as low as possible to prevent this “plastification” effect from the solvent.

Release Force



Release lacquers are often wax solutions in the appropriate solvent like Carnauba, Montana and Paraffin. Release resins are often combined with the wax solutions in order to provide consistent films applied on the substrate to avoid unevenness which often occurs when coatings waxes and to provide a higher solvent

resistance to avoid resolubilisation of the wax when the embossable coating is applied. This often produces metal pinholes on the PET after stamping. Release resins are designed to provide the lowest peel when the PET is released after stamping.



Normal coating weights for release compounds vary between 0.2 and 0.5 grs/sqm. Solvent selection must also be considered from the point of view of the release lacquer technology as some solvents are very aggressive to the conventional wax based release coatings. These solvents, especially toluene, would redissolve the wax and give tighter release bonds and some metal dots in the PET after stamping.

Colouring the lacquer

Embossable lacquer are often coloured using dyestuffs. There are three basic types of dyes:

- Acid Dyes. Anionic dyes soluble in water and insoluble in solvents
- Basic Dyes. Cationic dyes mostly soluble in water and alcohols but limited solubility in other solvents
- Solvent Dyes. Metal complex dyes soluble in a wide variety of solvents.

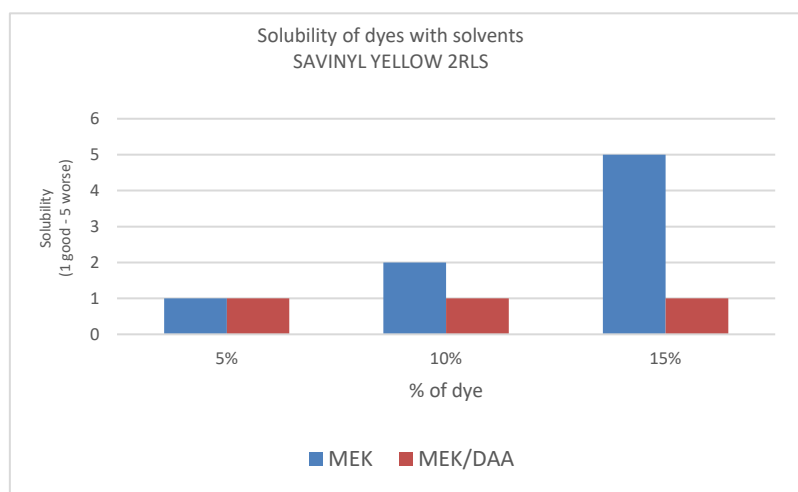
The dyes more often used are normally solvent dyes. These are dyes in which solubility in an organic solvent or solvents is a characteristic physical property. The properties of these dyes are strongly influenced by their solubility in a particular solvent, so it is usual to use a blend of solvents to obtain the optimum solvency and properties. Most of them have limited solubility in each solvent, so the maximum concentration of dye in a particular formulation with our Doresco Embossable lacquers is determined by the solvent and the solvent blend used in dilution and not the polymer by itself.

Typical dyes used in combination with our Doresco product portfolio are:

- Savinyl BLUE GLS (CI Solvent Blue 44)
- Savinyl FIRE RED 3GLS (CI Solvent Red 124)
- Savinyl RED 3BLS (CI Solvent Red 91)
- Savinyl YELLOW 2RLS (CI Solvent Yellow 82)

Typical levels into a coloured lacquer formulation vary between 5 to 15% on weight. Typical solvents and solvent blends in the dilution of our Doresco would be:

- MEK
- MEK / Diacetone alcohol (1:1)
- MEK / Ciclohexanone



These dyes often have very poor solubility in toluene and esters, but they do have very good solubility in ketones and alcohols. The correct balance between the solvent blend to be used must be found for each one of the dyes used as they will have different solubility parameters depending on their chemical index, but always taking care of their effect on the drying time and its performance on press depending on the drying capacity and press speed.