

Bonds that last

Novamelt GmbH is a family owned producer of hotmelt pressure sensitive adhesives (HMPSAs) with production sites in Germany and the US.

Twenty years ago the founders saw the potential market growth in HMPSA due to economic and environmental reasons. At that time the market was predominantly using water based and solvent based PSAs. They could clearly see an opportunity to develop and build a dynamic new PSA business around 100% rubber and/or acrylic based PSA technology avoiding energy demands for drying and solvent recovery in coating processes. At that time there was no highly specialised adhesive company in the market that was focussing on this exciting opportunity. Applications of HMPSA require in most industrial areas technical input and expertise. The founders were convinced that the family owned business offers the best solution for developing products for exciting new market opportunities.

Now, twenty yeas later it proved to be the right decision. After 20 years in business with ten years of own production Novamelt is one of the key players in the HMPSA business worldwide with the headquarter in Wehr in southern Germany near the border to Switzerland. Having tremendous success in Europe the company was encouraged to invest in a brand new HMPSA production and lab facility in the US in 2006. The investment in the US was supported by the German family owned adhesive producer Jowat AG, located in the northern part of Germany, which already had a facility in High Point, North Carolina. The new company is named Novamelt-Jowat LLC, indicating that Novamelt holds a majority in shares. With production facilities in the Euro and Dollar area Novamelt is well prepared to meet the customer needs globally.

Main markets for Novamelt are adhesives for label stock, speciality tapes, medical products, building and automotive industry as well as for product assembly. In the label area we offer solutions for every kind of application either using rubber based HMPSAs or UV-Acrylic based HMPSAs.

The core range covers adhesives for labelling at room temperature to card board or shampoo and beer bottles as well as adhesive for labelling cold and humid food packaging (low energy surface packaging materials) at around freezing point. There are also solutions available for the labelling of frozen food at -25°C and the labelling of tyres.

In the technical part I want to focus on different solutions for “No-Label-Look”-Labels, wash off and wet wipe applications.

There are different adhesive technologies in the market that can be used for label stock: Acrylic dispersions, solvent acrylic, solvent rubber, rubber based hot melt and UV-Acrylic HMPSAs. All these technologies have their advantages and disadvantages which are shown in the following graph, were the key advantages of rubber based HMPSAs and UV-Acrylic based HMPSA are highlighted:

For rubber based HMPSA the key advantages are a very broad adjustable adhesion profile, very good adhesion to polar, non polar and humid surfaces, high resistance to water and moisture and comparatively low adhesive cost. Also the investment for

coating equipment is comparatively low as you do not need huge drying ovens and therefore less space in the production building.

For UV-Acrylic based HMPSA the key advantages are very good adhesion to polar and non polar surfaces, a very good high temperature and chemical resistance. Also die cutting and matrix stripping properties are excellent. The investment cost for coating equipment is slightly higher than for rubber based adhesives as you need UV-lamps.

Properties	Acrylic dispersion	Solvent Acrylic	Rubber based HMPSA	UV-Acrylic based HMPSA
adjustable adhesion profile	++	+++	+++	++
Adhesion to polar surfaces	+++	+++	+++	+++
Adhesion to non polar surfaces	++	++	+++	+++
Adhesion to non polar humid surfaces	+	+++	+++	++
Shear strength	++	++++	+	++
Temperature resistance	+++	++++	++	+++
Die cutting properties	+++	+++	++	+++
Water and moisture resistance	+	++	+++	++
Investment cost for coating equipment	+++	++++	+	+
Adhesive Cost	+	+++	+	+++

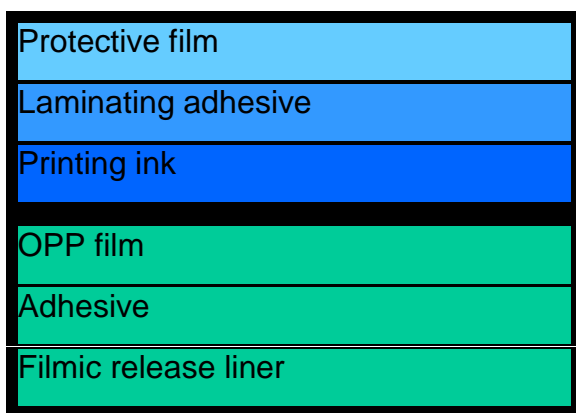
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Due to the low investment cost for coating equipment for rubber based HMPSA or UV-HMPSA it makes sense to use these technologies for an in house "No-Label-

Look” production for a printer using reverse printing technology. In addition to that the coating equipment can be integrated in an existing printing press.

No-Label-Look

Main requirements for NLL adhesives are a high transparency and sufficient chemical resistance against the ingredients of the labelled packaging. In addition to that a high UV-stability is necessary in order to prevent the yellowing of the adhesive and therefore the yellowing of the label. It is obvious that the adhesion to low energy surface materials has to be good in order to prevent the label from falling off. Another necessity are good converting properties such as die cutting, matrix stripping and the suitability of the adhesive for high speed labelling.



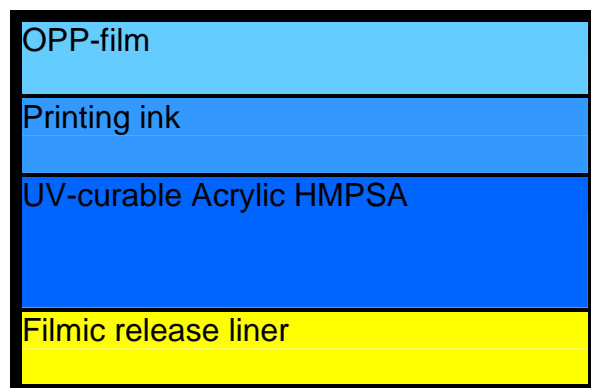
In a typical construction currently used for NLL the green section, which is the clear to clear laminate, has to be bought in by the label printer. Available clear to clear laminates are relatively expensive and the choice in terms of adhesion properties is limited.

The blue section describes the process steps that a printer has to perform: Printing on the laminate, application of a laminating adhesive and afterwards lamination with a protective film. This protective film has to

full fill three key tasks: Protecting the printing ink from scratching, improvement of chemical resistance and protection of the content of the bottle from interactions with the printing ink.

In the following construction the clear to clear laminate is produced by the label printer himself. The OPP film is reverse printed, coated with HMPSA or UV-HMPSA, and laminated with the release liner.

The advantages in this construction are obvious: unlimited choice of adhesive (re-open able, re-positional or permanent), no need of laminating adhesive and protective film.



With this construction it is possible to save up to 20% of material costs. But this is not the only advantage: The label printer will be more flexible in terms of lead times and batch sizes. Due to today's competition and cost driven market the label printers now have a unique opportunity to be one step ahead of their competition and therefore better securing their future business.

As indicated before it is possible to use either rubber based HMPSA or UV-Acrylic HMPSA to produce this construction. But when do you use which technology?

For high end NLL construction it is adequate to use UV-Acrylic HMPSA as there are certain advantages such as high chemical resistance and UV-resistance but of course there are also some disadvantages: comparatively higher adhesive cost and a slightly higher investment in the coating equipment because of the UV-lamps
 Products to be used for NLL-Construction out of the Novamelt portfolio are summarized in the following table

	Rubber based HMPSA		UV-Acrylic HMPSA	
	permanent	remove able	permanent	remove able
	Novamelt PS 1712	Novamelt PS 4010	Novarad RC 21151	Novarad RC 24110
180° peel to SS	22 N/inch	4 N/inch	11 N/inch	5 N/inch

Using these products you are able to offer individual customer solutions in terms of adhesive profile, adhesive technology and pricing.

For permanent applications you can use the rubber based adhesive Novamelt PS 1711 or the UV-acrylic based Novarad RC 21151. In terms of remove able adhesives there is the choice between the rubber based product Novamelt PS 4010 or the UV-acrylic adhesive Novarad RC 24110.

Wash off

Also wash off labels for beer bottles are a NLL construction. In this case the first adhesive choice is UV-Acrylic HMPSA because of its unique properties. Of course this construction does not only depend on the adhesive that is used, but also on the face material as it supports the wash off process. In this paper the focus will be on the adhesive.

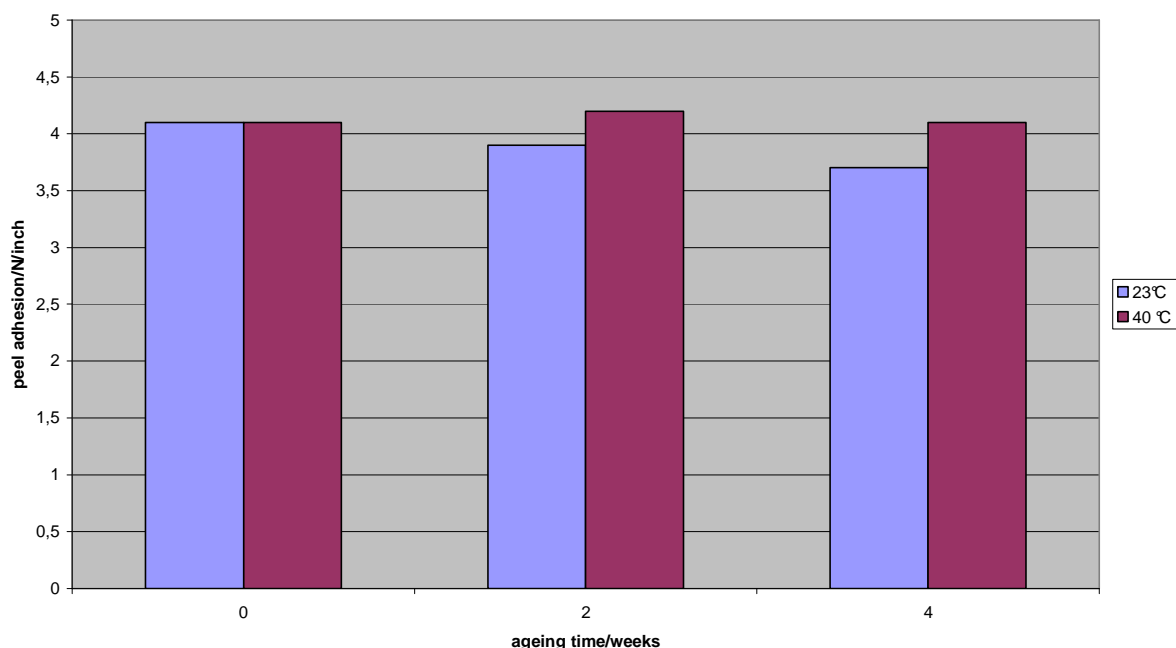


Typical requirements for NLL wash off beer labels are high transparency, well balanced adhesion properties to assure wash off properties and an acceptable mandrel performance for labeling the bottle neck. Also very important is a sufficient cold water resistance and no water whitening of the adhesive in ice water.

Usually the wash off process is done at 80°C in a caustic environment (2% NaOH) and an expected wash off time of two Minutes at the most. As you can imagine there were a lot of factors that had to be taken into consideration while this adhesive has been developed

The most important property is a consistent wash off time of the label also after being in the market for several weeks. This means that there is no adhesion build up to glass over time. As indicated in the chart below there is no significant increase in peel over four weeks ageing at ambient temperature and at 40°C. The ageing test was done with a 18gsm coating of RC 24110 to a 60µm BOPP. The samples were applied to glass plates under defined conditions as required to run a Finat FTM1 peel testing. For the ambient temperature ageing the specimen were placed in a drawer in an air conditioned room and for the 40°C ageing they were placed in an oven.

Ageing of Novarad RC 24110 on glass at 23°C and 40° C



Wet Wipe closures



For an adhesive usable for wet wipe closures there are several requirements for the adhesive. Besides a very soft opening the packaging has also to be closed and re-opened again for several times. Due to the chemically aggressive ingredients for example in house hold wipes for sanitary areas the chemical resistance of the adhesive has to be excellent. Also the resistance to oil has to be superior as baby wipes contain a lot of it. In addition to that the adhesive has to work even when contaminated with the ingredients of the wet wipe. These challenging requirements can be met by UV-curable acrylic HMPSAs.

As there are different packaging materials on the market and as there are slightly different requirements

from different customers we have developed a range of UV-curable acrylic adhesives for this demanding application.

cured at 10m/min 190W/cm H-Bulb	Unit	Novarad RC 24360	Novarad RC 24365	Novarad RC 24370
Adhesion properties (20gsm to OPP)				
180° peel to PET film	N/inch	3,8	2,1	1,6
180° peel to soft touch film	N/inch	3,8	2,3	1,5
180° peel to BDF film	N/inch	3,8	1,9	1,3
SAFT (0,5°C/min; 0,5kg)	°C	142	130	86
Open/closure behaviour				
to PET film		zippy/noisy	soft	very soft
to soft touch film		zippy/noisy	soft	very soft
to BDF film		zippy/noisy	soft	very soft

The differences of these three adhesives are the peel values and the opening behaviour to the different packaging films.

Using one of the above mentioned adhesives you are able to create customer specific solutions on each available packaging film. For high adhesion there is Novarad RC 24360, for medium adhesion and softness there is Novarad RC 24365 and for low adhesion and very soft opening there is Novarad RC 24370.

Outlook

One of the most important questions for all of us is: How will the future of the label market look like?

In the time of an economic crises in most parts of the world we observe that the market offers more and more space for individual customer solutions.

We see the products and applications presented today as an excellent means to strengthen your market position and to secure your future business. In addition to that this technique helps you to differentiate from your competition and to create added value. You will be able to supply your customers with individual solutions, and what is even more important, you create "Bonds that last"

Superior performance – Self adhesive labels using
UV-Acrylic adhesives

	Acrylic dispersion	Solvent Acrylic	Ruber based HMPSA	UV-Acrylic HMPSA
Adhesive cost	+	+++	+	+++
Adjustable adhesion profile	++	+++	+++	++
Adhesion to polar surfaces	+++	+++	+++	+++

	Acrylic dispersion	Solvent Acrylic	Ruber based HMPSA	UV-Acrylic HMPSA
Adhesion to non polar surfaces	++	++	+++	+++
Adhesion to non polar humid surf.	+	++	+++	++
Shear strength	++	++++	+	++

	Acrylic dispersion	Solvent Acrylic	Ruber based HMPSA	UV-Acrylic HMPSA
Temperature resistance	+++	++++	++	+++
Die cutting properties	+++	+++	+++	+++
Water and moisture resistance	+	+++	+++	++

	Acrylic dispersion	Solvent Acrylic	Ruber based HMPSA	UV-Acrylic HMPSA
Investment cost for coating equipment	+++	++++	+	++

- Where does it make sense to use UV-Acrylic HMPSA?
 - Label printer
 - In house laminate/label production of specialities and highend labels
 - Integration of equipment in printing press
 - Increased specialisation and therefore differentiation
 - Commercial advantage compared to ready made laminate
 - Unlimited choice of adhesives

Challenge: Proper adhesive curing
right choice of release liner

- Where does it make sense to use UV-Acrylic HMPSA?
 - Label Laminate producer
 - Low investment for modifying HM-coater
 - Shift from solvent to solvent-less technology
 - Free capacity on solvent coater
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- What are the key advantages of UV-Acrylic HMPSA?
 - High transparency
 - Chemical resistance
 - UV resistance
 - Good adhesion to standard packaging materials
 - Excellent die cutting
 - Suitable for high speed labeling
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- Applications to be discussed
 - Wash off labels
 - Wet wipe closures
 - High permanent labels

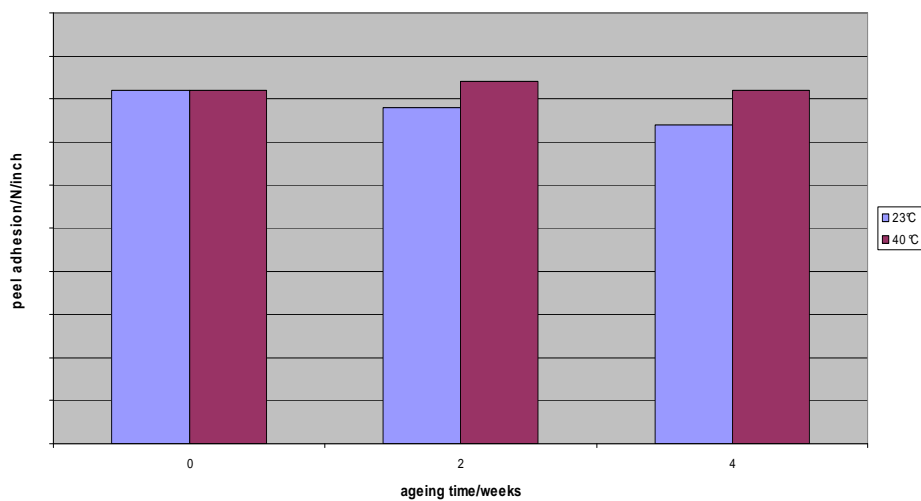
	Wet glue labels	Permanent Label	Wash off label using UV-Acrylics
Face material	thin paper	paper/filmic	filmic
Label appearance	standard	standard/ high quality	high quality
Label transparency	no	no/yes	yes
Re-use ability of bottle	yes	no	yes

Wash off labels



- Typical NLL construction
- Major influence of face material
- Balanced adhesion/shear properties
- Acceptable mandrell performance
- Ice water test
- Consistent wash off times
- No peel increase on bottle over time

Ageing of UV-wash off adhesive on glass at 23°C and 40°C



Wet wipe closures



- Open and re-close possibility for several times
- No leaking of cleaning agent
- High chemical resistance of the adhesive versus oil and aggressive chemicals
- Different packaging materials
- Different opening behaviour

Wet wipe closures

10m/min; 190W/cm H-bulb 20gsm to OPP	Unit	Product 1	Product 2	Product 3
180° peel to PET film	N/inch	4	2	1,5
180° peel to soft touch film	N/inch	4	2	1,5
SAFT (0,5°C/min; 0,5kg)	°C	140	130	90
Open/closure behaviour				
PET film		zippy	soft	very soft
Soft touch film		zippy	soft	very soft

High permanent labels



- Toll stickers
 - permanent bond to windshield
 - UV-resistance
 - high/low temperature resistance
 - additional security features incorporated
- Authenticity labels
 - permanent bond to card board
 - high/low temperature resistance
 - additional security features incorporated

10m/min; 240W/cm H-bulb 25gsm to PET	Unit	High permanent adhesive
180° peel to steel (20min)	N/inch	26 - 29
Looptack to glass (FTM9)	N/inch	17 - 19
SAFT (0,5°C/min; 0,5kg)	°C	130

- Summary
 - UV-Acrylic HMPSAs offer interesting combinations of properties
 - Comparatively low investment cost
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