

Small PSA Bonding Compendium

Purpose of this Compendium

- Is addressed to users of Lohmann's Duplo**COLL**® adhesive tapes.
- Is meant to give information on the essential prerequisites as well as tips for a high quality application and finishing.
- Development of application-oriented processing instructions for the Adhesive Bonder (executive staff).
- Supporting the user in quality requirements for pressure sensitive adhesive applications for permanent adhesive bonds according e.g. to standard DVS 3320-2, status: January 2019.

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Status: 2019

Surface preparation

A very important factor for a functional bond is the optimal preparation of the join partners to ensure the required adhesive forces can be established.

To achieve an optimum adhesion, the surfaces to be bonded have to be clean, dry and free of grease. Thus, cleaning the surface is meant to remove adherent substances such as oil, fats and waxes, release agents, dust etc.

Organic solvents for various types of contamination are ready as detergents, like:



Contamintaion	Hydrocarbons	Alcohols	Ketones, Esters
Cutting oil	0	0	+
Preservative oil	+	0	+
Waxes	+	0	0
Lubricants	+	0	+
Resin	+	+	+
Adhesive (not cured)	-	0	0
Finger prints	-	+	+
Silicone oil	-	-	-

+ = suitable 0 = limited suitability - = not suitable

Please only use clean cloths for cleaning the surfaces while applying solvents with material compatability like benzines, alcohols, ester or ketones. If neccessary, change the wipes frequently. All solvents have to evaporate residue-freely before bonding. Before that, the solvent resistance of the material to be bonded has to be verified.

In general, the respective safety data sheets of the input materials have to be considered.

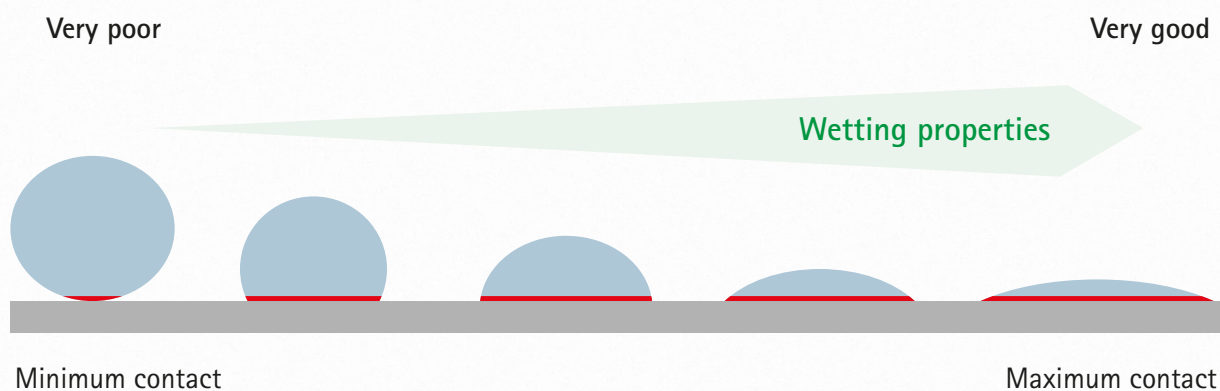
Surface energy and wetting

Pressure sensitive adhesives are materials that feature characteristics of liquids and solids at the same time. This special property is called viscoelasticity.

Due to their solid nature, PSAs are able to transfer forces via a glue line.

Due to its liquid nature, a PSA can wet a surface to be bonded (substrate). Subsequently, so-called „adhesive forces“ occur.

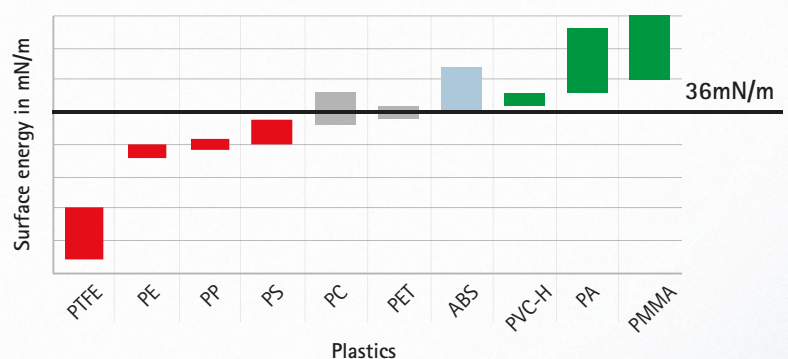
Wetting is the build-up of a maximum contact surface between the PSA and the respective substrate. The illustration exemplifies the correlation between the wetting characteristics of a liquid and its build-up of a contact surface to a substrate surface.



Serving as a guideline for the classification of the surface energy and wettability of plastics, have a look at the figure below.

Plastics with a surface energy of $\geq 36\text{mN/m}$ can be regarded as easily wettable. For these materials all standard PSA systems can be used. For plastics with lower surface energies only selected PSA systems can be applied or appropriate surface pre-treatments have to modify the surface energy.

Surface energy of standard technical plastics



Tips for bonding ranges of materials

Plastics

Plastics can be distinguished between thermoplastics, thermosetting plastics and elastomers

- Thermoplastics are meltable, weldable and prone to creeping, i.a. because of high mechanical loads (e.g. PP (polypropylene), PE (polyethylene)).
- Thermosetting plastics are brittle and high-strength plastics with high chemical and temperature resistance (e.g. epoxy).
- Elastomers are deformable by means of pressure or expansion, they are prone to creeping and have a limited resistance against chemicals and temperature (e.g. rubber, polyurethane).
- For the applicability of PSAs on plastics, their surface energy, thermal resistance, behavior under mechanical stress and compatibility with the PSA system (migration behavior) have to be evaluated.

Metals

- While metals bond well with PSAs a possible oxidation has to be taken into account. To avoid oxidation, metals are additionally equipped with a surface coating (e.g. paints, galvanizing, anodization). Because of that, the adhesion on these coats has to be assessed.

Glass

- Glass is considered as a highly energetic material that can be easily bonded. For applications that are expected to involve humidity, the special hydrophile quality of glass has to be considered (formation of a permanent water film at the boundary layer). Especially in bonds that transfer loads, a suitable pre-treatment of the glass surface is key to guarantee a durable bond.

Influencing factors on the bond

For the selection of the adhesive system, the bonding friendly construction as well as mechanical loads are significant factors for a durable bond. According to the principle: the actual loads have to be lower than the the one during the operating life.

Due to the permanently visco-elastic behavior of PSAs, they are highly suitable for short-term, dynamic loads. Their creeping tendency during a permanent load has to be considered for the construction.

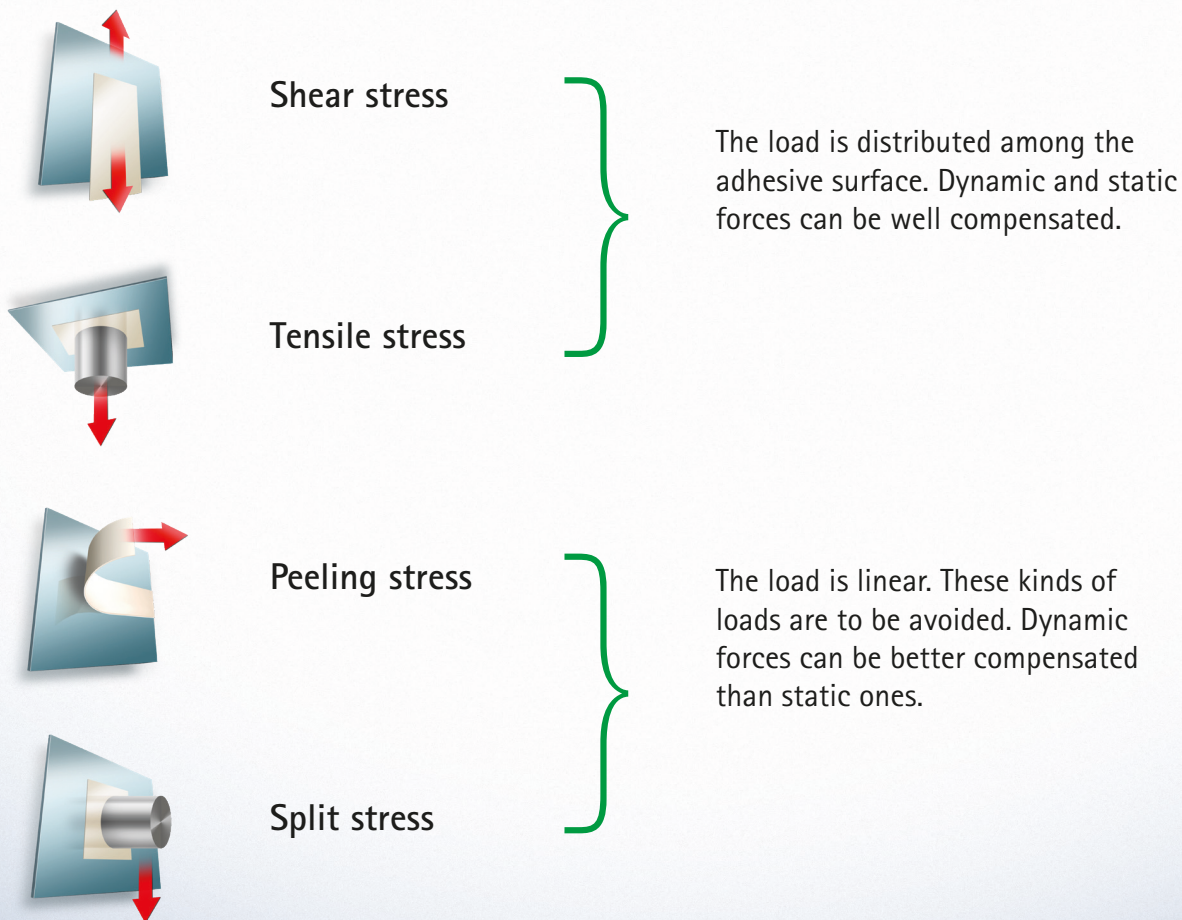
For the bond, the following influences should be considered over the planned operating life:

Weather conditions

Temperature, UV-radiation and humidity

Aging

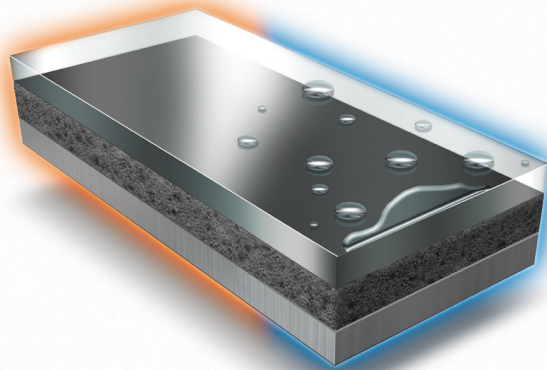
Chemical influences + time + mechanical impacts



Influencing factors on the bond

Weather resistance

For external applications, influencing factors such as UV-radiation, humidity, heat, cold and other environmental factors have to be taken into account. PSAs based on pure acrylate are preferable. They are aging- as well as weather-resistant.



Chemical influences

For many applications adhesive tapes and adhesives have to be resistant against chemical influences, e.g. solvents, oils, acids, alkalis or plasticizers. Here, PSAs based on pure acrylate are preferable.

Aging

PSAs with extensively modified adhesive substances age differently according to varying environmental factors. Thus, with selecting a type of adhesive one should always take into consideration the service life within the application.

Influence of temperature

The temperature resistance strongly depends on the types of loads as well as their size and duration.

There is a difference between short-term loads (minutes to hours) and permanent loads (days, weeks, years).

Low temperatures make for

- Hard, brittle adhesive
- Increased static shear strength
- Lower initial tack

High temperatures make for

- Adhesive softening
- Reduced shear strength
- Higher initial tack

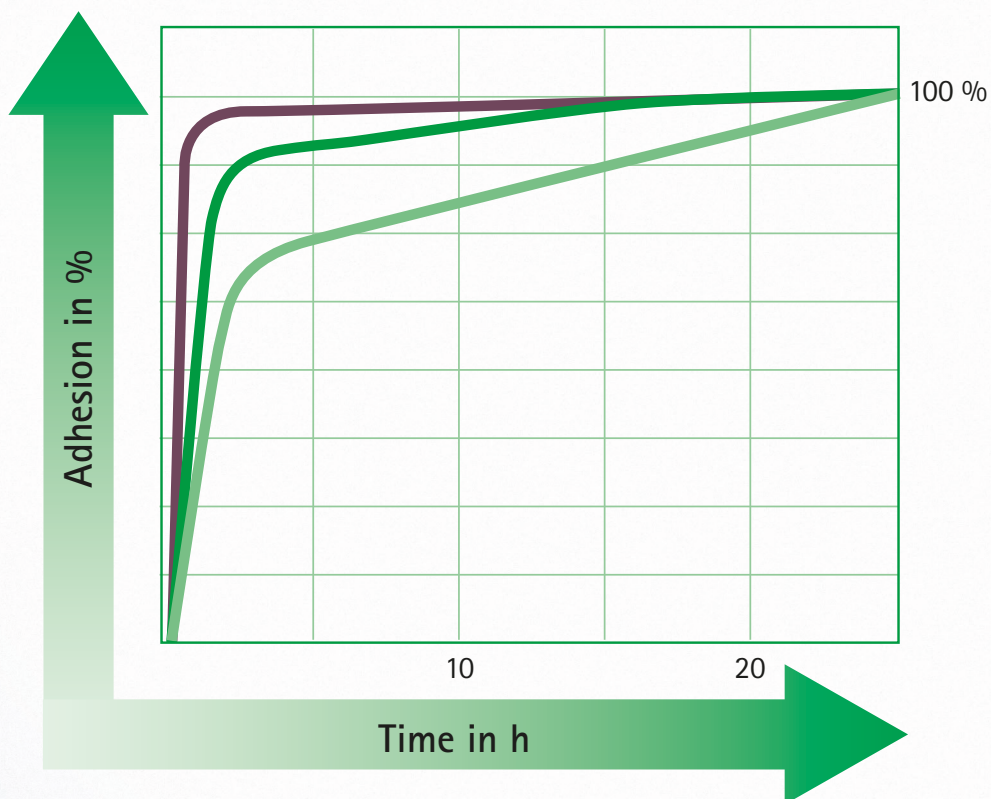
Influence of time on the adhesion

Initial and final adhesion

Soft-set adhesives have a higher initial tack than hard-set ones. For bonds that demand a high final adhesion, hard-set adhesives are favorable.

After a holding time of two days, the final adhesion of hard-set adhesives is achieved.

Time-dependent change



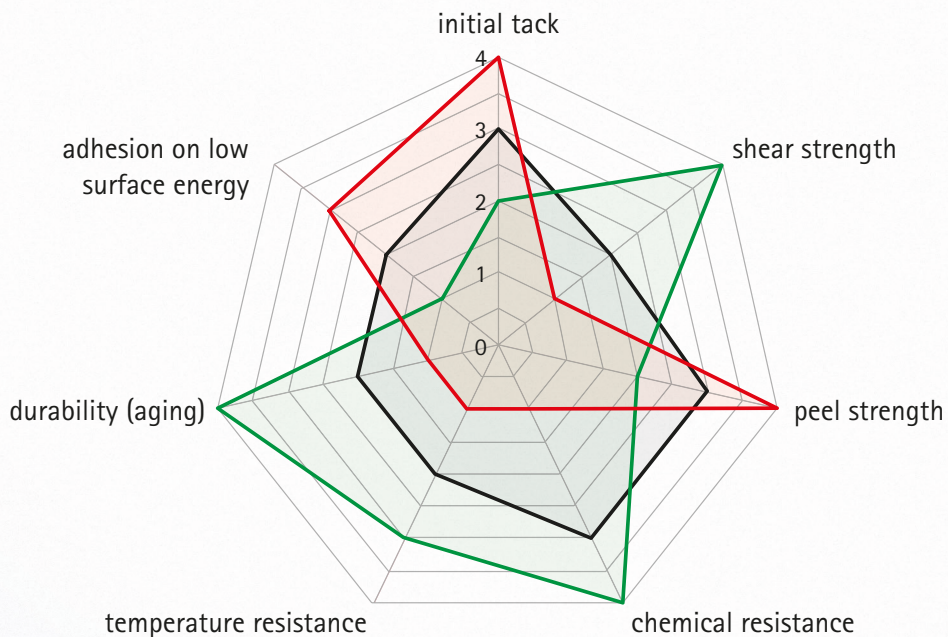
- High viscous content (rubber adhesives)
- Medium viscous content (modified acrylates)
- Low viscous content (pure acrylates)

Pressure Sensitive Adhesive Families

- Lohmann offers PSA systems, especially based on acrylates and rubbers.
- Depending on the manufacturing method of the coating process, you can distinguish between PSAs that are dissolved in solvents or emulsified in water or work as 100% systems (hotmelt PSAs, UV-PSAs).
- PSAs can be modified and thus changed in their qualities. For example, to achieve a higher initial tack so-called tackifiers can be added (e.g. resins).
- Essentially, PSAs differ in qualities such as:

PSA adhesive families

— pure acrylic solvent-based PSA — modified acrylic solvent-based PSA — rubber-based PSA



Storage stability

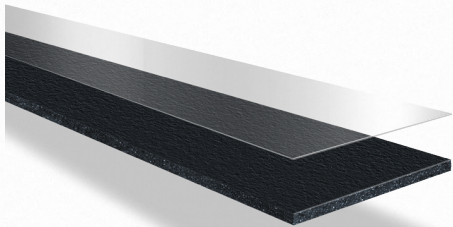
- In general, the storage stability of an adhesive tape guarantees its initial characteristics remain unchanged under defined stored conditions. Thus, the processability within the bonding process is ensured.
- PSA tapes are to be stored at room temperature and normal humidity (50-70%).
- Adhesive tapes are to be stored in their original packaging, protected from dust and light and away from heat sources. Rolls and bars have to be stored in a manner that prevents unintentional deformation. The roll's dead weight should be discharged via its core.
- Product specific shelf lives can be found in the respective data sheets.



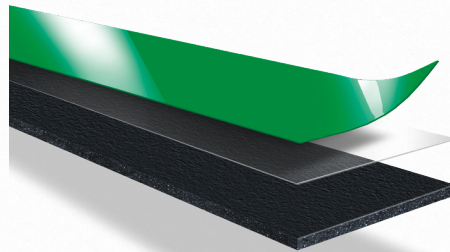
PSA tape structure

In general, pressure sensitive adhesive tapes are provided as rolls, spools or die-cuts. They are distinguished between:

Single-sided adhesive tape with or without liner

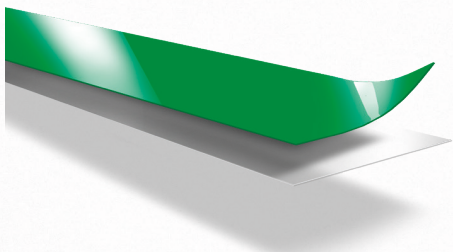


single-sided adhesive tape with adhesive layer and carrier

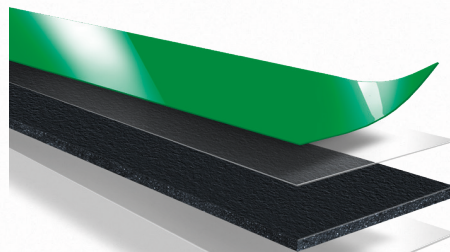


single-sided adhesive tape with adhesive layer and carrier and additional liner

Double-sided adhesive tapes



transfer adhesive tape without carrier



double-sided adhesive tape with carrier and liner

The liner (e.g. paper, film) is protecting the PSA layer.
The carrier (e.g. fabric, film, paper, foam) is coated with the pressure-sensitive adhesive on both sides and fulfils different functions, e.g. enhancement, barrier or sealing.

IMPORTANT NOTICE

All information and recommendations are given to the best of our knowledge and practical experiences. Many factors beyond our control and uniquely within buyer's scope can affect the use and performance of our tape in a particular application. Except as expressly agreed in writing we do not take over any warranty or liability for the suitability or usability of our tapes for certain purposes and applications resulting from the buyer's special usage of the tapes. Except where provided by mandatory legal provisions, we will not be liable for any direct or indirect material or immaterial losses or damages arising from the application of our tapes. Solely the buyer is responsible for determining the suitability of the specific tape for its use in connection with his method of application. Please consult our Application Engineering for specific advice.