BONDING +
SEALING +
ENCAPSULATION

Kisling

Instructions for use
of polyurethane – encapsulants for manual processing

Shelf life / transport

Both components of our encapsulants have a shelf life of 6 months when stored in original sealed containers. If you purchase our encapsulants in drums and divide them into smaller containers, please use those containers within a maximum of 4 weeks. Before refilling resin (component A) from drums into smaller containers, please homogenize it thoroughly before.
Especially the cold-sensitive hardeners should be transported in “thermo trucks” during winter months, to avoid deviation from the recommended transport temperature of+15°C up to + 50°C.

Storage

The resin and hardener components must be stored in a dry place at a temperature of +15°C to +25°C. We recommend to store the material on a pallet or drip tray. Furthermore, the components should not be exposed to cold draughts or cold hall floors.
If these storage conditions are not observed respectively controlled and the material is stored at temperatures below +15°C, crystallisation of the hardener may occur. This is shown by the fact that it leads to clumping or clouding. Should this occur, the hardener must no longer be used under any circumstances. On the other hand, temperatures above +25°C may lead to sedimentation of the fillers within the resin.

Material preparation

Before opening the respective containers, make sure that there are no impurities on the closure. During processing, both components must be adapted to the respective production environment (room temperature). Resin and hardener components must always be protected from moisture. It is recommended to carry out homogenisation before each material withdrawal. Especially in the case of filled resin components, fillers can settle on the bottom and lead to “over- or under-cross-linking” during processing. Unfilled polyurethane systems also contain solids (drying agents) that can sediment and must therefore be stirred before use. If the cross-linking is incorrect, the resin will then have different mechanical, thermal and electrical properties than those specified in the technical data sheet. Stirring can be done manually using a fine rod or spatula, but also mechanically using a drill with a stirring attachment or using a special stirring unit. In this case, cup stirrers are preferred to paddle stirrers. During the stirring process, the stirring in of air should generally be avoided. Therefore, the agitator/drill should be set at 100 to 300 rpm. After homogenisation, evacuation of the stirred-in air is strongly recommended.

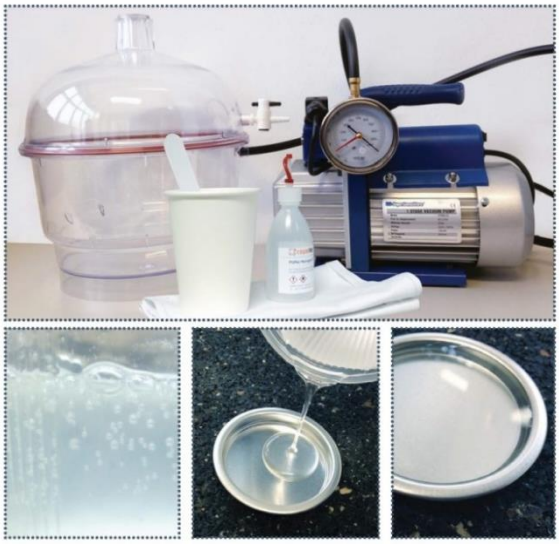
Kisling (Deutschland) GmbH | Salzstraße 15 | 74676 Niedernhall | Germany
Mail address: Waldstraße 15 | 71139 Ehningen | Germany
P +49 7940 50961 61 | info_de@kisling.com | www.kisling.com
Registered office in Künzelsau, Registration court Stuttgart HRB 571451 | VAT: DE 213 424 398
CEO: Dr. Dirk Clemens
Deutsche Bank AG, Heilbronn | IBAN: DE89 6207 0081 0015 4385 00 | BIC: DEUTDESS620

Preparation of the parts

Encapsulants are generally sensitive to moisture during processing. Since moisture can lead to bubble formation during curing, it is urgently necessary to dry components before casting. We recommend drying for 1 to 2 hours, at +60°C to +80°C in an oven. The relative humidity in the working environment should not exceed 40 to 60% RH. In general, the sensitivity of resin and hardener to different plastic surfaces varies greatly. Please consult our development department in individual cases. Another advantage of preheating the components is the influence on the flow behaviour. A temperature-controlled component heats up the encapsulant, which reduces its viscosity. This allows the encapsulant to flow faster and better into any cavities. Component temperatures of up to +60°C are not harmful to the uncured encapsulant but will accelerate the curing process. Furthermore, bubble formation is minimised. The curing temperature should not exceed +80°C, otherwise stresses could arise within the system that could lead to cracking. In general, the component geometry determines whether curing should be carried out at an increased temperature or not. For components with narrow gaps or windings, such as coils, there is a risk that trapped air bubbles will rise more slowly and thus appear as bubbles under the surface.

Processing

For manual potting, a small batch (e.g. 200g resin/hardener mixture) is recommended. The mixing ratio can be taken from the technical data sheet and should be applied exactly. A laboratory balance is suitable here. The deviation, related to the hardener, must not exceed ± 3%. With a mixing ratio of e.g. 100: 30, the "tolerable" deviation is 100: 29.1 – 100: 30.9. Excess hardener can react with the humidity in the air, which strongly favours the formation of carbon dioxide and thus leads to bubble formation. The resin and hardener components should be mixed thoroughly until a homogeneous mass is obtained. It is also important to stir in any residue on the rim and bottom of the container.
Stirring brings air into the system, so the mixture should be degassed under vacuum. We also offer a vacuum set for this purpose (see illustration below). Here we recommend a vacuum of 100 to 30 mbar (as low as possible). Depending on the potting quantity, pot life and viscosity, 2 – 10 minutes are normally sufficient for evacuation. The material is completely degassed if no more bubbles are observed.



Curing

As a rule, 95% curing takes place after 12 to 24 hours at room temperature. This process can be accelerated by curing at elevated temperatures. For this purpose, curing at +80°C for 2 hours is recommended. After 14 days at room temperature at the latest, the encapsulant reaches its final chemical curing. Here, too, the process can be accelerated. For this purpose, tempering at +40°C for at least 120 hours is recommended. Electrical tests of the component quality can usually be carried out directly after potting. If the dielectric constant plays a role in the electrical test, a test on the encapsulant can usually be carried out after 24 hours at room temperature.

Processing errors

The encapsulant does not harden or has a sticky surface

In this case, it is recommended to post-cure the cast components for a further 1 to 2 hours at +60°C – +80°C. If no further curing takes place, there is most likely an "under-cross-linking" of the encapsulant. The hardener content was therefore too low. In this case, the mixing ratio should be checked again. Careful homogenisation of the encapsulant should also be ensured. Uneven curing can also be influenced by other media, such as the use of encapsulants with a different chemical base, incompletely cured lacquers or adhesives, solvents, release agents, oils, etc.

The encapsulant is only hard or soft in certain places

Inhomogeneities occur when the resin and hardener components are not thoroughly mixed. As a result, "under-cross-linking" may occur in some cases. When retrying, the encapsulant should be thoroughly mixed with the hardener.

The encapsulant shows bubble formation

Bubbles within the system can have various causes:

1. Air was stirred in and could not escape completely during curing. Alternatively, there could also be air in the tubes of the dosing equipment. Small, pinprick-shaped air bubbles are characteristic of this.

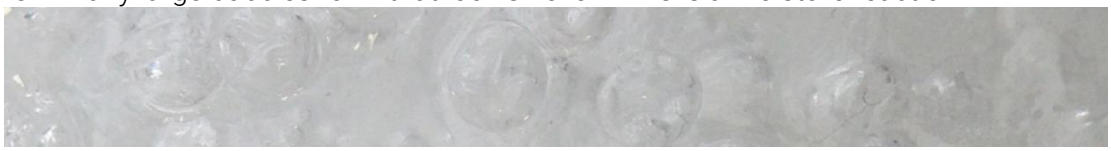
   

   We recommend deaerating the resin under vacuum after homogenisation as well as the mixture after mixing.

2. Air has come to the surface at the time of the gel point and has not burst open.

The formation of bubbles can be avoided by tempering the component beforehand and the stirred-in air could escape better. In addition, the casting process should be adjusted so that the encapsulant displaces the air from the component during potting. It is advisable to start the potting on an outer side so that trapped air can escape upwards with the pressure and potting speed on the other side. Curing at room temperature may also be successful

3. Many large bubbles form that look swollen. This is a moisture reaction.



a. First of all, the resin or hardener component might have already absorbed a lot of moisture during stirring or by opening the container too long or too often. To check this, a curing sample (resin + hardener) should be cured in a dry plastic cup in the oven for two hours at +60°C – +80°C. If the same bubble formation appears again, the resin or hardener component must be replaced. If the same bubble formation appears again, the resin component is already damaged.
b. Furthermore, the moulded part could have too much surface moisture, as is often the case with polyamide housings or coils, for example. The typical defect here is mainly bubbles at the edge of the housing or above coils. To check this, pre-dried parts should be casted and cured according to specifications. Curing in a dry atmosphere and an air-conditioned room is highly advisable.
c. If the liquid encapsulant has been in contact with chemicals (solvents, release agents, varnishes, adhesive tapes, etc.) before curing, it can also lead to bubble formation. When retesting, ensure that previously applied media have fully cured. Release agents should have completely evaporated.

Change in properties

Processing time (pot life) and curing

Note that the pot life cannot be controlled by adding more or less hardener. The mixing ratio must be adhered to exactly. We will be happy to advise you on this subject in more detail.
In general, the processing time is largely dependent on the geometry of the component. The curing can be accelerated by applying heat at +60°C – +80°C. Furthermore, it is also possible to shorten the curing time by using IR radiators.

Viscosity

The following also applies here: the viscosity must not be changed by adding more or less hardener. If you would like to change the viscosity, please contact your contact person.

Hardness

The following also applies to the hardness of the moulding material: The hardness cannot be increased by adding more hardener, as this could lead to “over-cross-linking” with a negative effect on the mechanical properties of the polyurethane. If you would like a different hardness for your moulding, please do not hesitate to contact your contact person. We will also be happy to advise you on our range of encapsulants.

Important note:

The instructions are to be understood as general guidelines. Please refer to the safety data for your own safety and to the technical datasheet for the correct processing.

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