

Article: time-based adhesive selection

The latest issue of **FAST** magazine comes complete with this article about time-based adhesive selection. Factors like shelf life, working life and cure time may all be relevant to your production. It only takes five minutes to [read it](#).

ADHESIVES

CONSIDER THIS...

When specifying an adhesive, shelf life, working life and cure speed are selection factors to consider. A good understanding of these factors can help manufacturers improve productivity and reduce waste. Here Peter Swanton, managing director of Inhertra, explains the time-based considerations when working with adhesives.

Every adhesive will come with a shelf life. The shelf life is the length of time from the date of manufacture during which the material is under warranty to behave according to the intended data sheet, assuming the storage conditions have been met. It also appears on the label as the expiry date – inferring to the date that the shelf life ends – at an unaccelerated time. If the data sheet lists a manufacturing date, you can find the shelf life and calculate the expiry date.

An adhesive that remains stored in the original packaging, and has been stored under recommended conditions, may still begin to see negative effects beyond the shelf life. The effects can be merely inoperative or be part of a slow decay in performance. Changes in the adhesive may include longer cure times, failure to cure, gelling in the package, changes in viscosity, expansion/contraction or decrease in performance. While adhesives don't usually become completely unusable as the result of reaching the end of the shelf life, at this point the risk is steadily going up for the user.

We are often asked if it is still alright to use an adhesive past its expiry date, especially when production needs are pressing, and the supply chain has not yet been established. Inhertra's advice is a quick test (if only we had one!) would be to check cure speed under your exact process/ambient conditions and compare it with your original process evaluation test records. A more rigorous way would be to do so many finished parts on the original product as you can to see if it still meets your needs. A guide would be the testing you did initially to validate the adhesive in the application. After all, this is the only and ultimate arbiter of suitability of the adhesive for your needs.

Nonetheless, the use of the expired product would still be at your risk. Many businesses choose not to take this risk, weighing up the cost of more material or production delay against the loss of reputation by missing a post-quality problem.

The conditions the adhesive is stored in can affect the shelf life. Temperature extremes can impact both stability and efficiency. Further advice, ensure that your adhesives are stored correctly according to the manufacturer's recommendations. Choosing an adhesive with a limited shelf life will cause working with a supplier with an appreciation of the inevitable supply chain challenges.

"While pot life and working life are often taken to mean the same thing, there are distinctions between the two."

WORKING LIFE AND POT LIFE

While pot life and working life are often taken to mean the same thing, there are distinctions between the two. Both refer to the period of time after mixing or preparing an adhesive for use during which the material remains suitable for application.

Adhesives based on chemicals like epoxy, polyurethane, and two-part epoxies are often two-part systems where mixed, the clock starts ticking. Cure inhibitors and the material starts to thicken, meaning viscosity increases. In this case, pot life is a time period after the adhesive is mixed, as it is defined as the amount of time it takes for the material mixed viscosity to double, and it is extending the clock means. There are variations on this theme – the rate is affected by the mass of the material mixed and the temperature, so these factors should either be recorded or noted (e.g. using a scale at 25°C) if you want to make comparisons.

Many of these two-part materials will generate heat (exotherm) during the cure process, and as the temperature will increase during curing, and even this exotherm is related to the wetted mass, the more you mix, the shorter the pot life. UV curing adhesives, which are typically single part and require no mixing, might be said to have an indefinite pot life.



range what it takes on or be for your process.

Pot life can act as a guide to specifying your pot working life, but some practical considerations will be useful. Working life is generally shorter than pot life. There are risks in using a material beyond its stated pot life, even if it is still in its original container. If the pot life is too long for the application, then adhesion and other physical characteristics may be compromised.

Not all manufacturers quote pot life or working life in the same way, so be careful of reading data about competitors and use that figure as a guideline. Always test the material in your application and talk to an authoritative supplier. If the performance requires, you may use a material with a shorter pot life than ideal for your process, then use fully validated or increased material wastage from frequent mixing (double replacement or non-purge functions on mixing, mixing and dispensing machines).

CURE TIME

Cure time can vary from almost "instant" (cyanoacrylate adhesives), secondary (UV curing adhesives) to hours or even days (two-part ambient temperature epoxies or single part silicone RTV adhesive resins).

There is a distinction to be made between "handling time" or "B-stage time", and cure time. The former refers to the time

it takes for the adhesive to cure enough so that the parts can be moved with reasonable ease, perhaps in a handling area for full cure to occur, or to the next stage of the manufacturing process.

In a slow mold, adhesive cure time would fit in with the production line speed as determined by the rate of flow. Adhesive specification is always about compromise, however, so other selection factors (e.g. performance, regulatory compliance) may have to impact the ideal cure time factor. This may mean production bottlenecks, off-line curing, increased WIP, and the resultant required resources (space, time, energy). If assembly time or process are required, fast curing adhesives handling time inevitably means more steps with the associated costs.

If there are more steps, does fast curing adhesives like cyanoacrylate adhesives or UV curing adhesives cost other production efficiency? Before the assembly requires a two-part structural adhesive based on epoxy or methacrylate chemistry, then does it allow a balance to be drawn between working life and cure time.

Pot cure time after mixing also implies a short working life, and this may present a number of processing challenges. Higher volumes of continuous production can cope with this, under validation of consistent production will require careful planning to order to reduce material waste. Some of these two-part structural adhesives have cured readily accelerated by heat, although this may lead to be done offline in batch or in hot water.

selection allow easily to be done, or for example, by induction heating.

Recent innovations of adhesives have been and "hotbed" curing mechanisms to adhesive production bottlenecks. For example, a UV light cure to give fast cure time through another cure type.

There is not always better, it is possible for an adhesive to cure too quickly. For example, if you are working on a very large manufacturing job, where it takes so much time to apply and spread the adhesive before applying and positioning the laminate, you will need an adhesive with a working life longer than its cure time.

CONCLUSION

Shelf life, working life and cure speed are selection factors to consider when specifying an adhesive. It is worth noting that the cost of purchasing the adhesive is often more than the cost of purchasing the adhesive, so using these factors to guide production efficiency will save both time and money, reduce material waste and enhance productivity. ■

Inhertra
www.inhertra.co.uk
info@inhertra.co.uk



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Supplied by:



INTERTRONICS

12a Station Field Industrial Estate, Banbury Road, Kidlington

Oxfordshire England OX5 1JD

t 01865 842842 e info@intertronics.co.uk

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