UNVEIL THE IMPREGNATION JOURNEY

IMPREGNATION TIPS

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2020

JANUARY

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PERSONAL MEMORANDA

Name : ....

Designation : ....

Company Name :...

Office Address :...

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Residence Address : ....

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Mobile No. :..Telephone : ....

E-Mail :..

Driving Licence : ....

Saving Bank with : ....

Account No. : ....

Important Dates

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In case of Emergency

Name : ....

Relationship : ....

Mobile No. :.. Telephone :..

My Ambition 2025 : ....

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PASSION FOR EXCELLENCE & RESEARCH IN IMPREGNATION TECHNOLOGY

SAIBAL SEN

BE (Met.), MBA (1983)

World-renowned pioneer with four decades of experience

ss@teknosealindia.com

PROBAL SEN

BE (Mech), MCM (1987)

Internationally acclaimed Specialist with four decades of experience

ps@teknosealindia.com

By making our readers cognizant of the various intricacies of impregnation, we hope to boost their productivity, quality, and efficiency. We have made a sincere effort to disseminate as much information as possible so that our customers know the intricacies of this unique process to select the most suitable option. This data is the result of painstaking efforts of our team of experts.

Our sealants have earned global fame. Most their approval about the efficacy of our products. We are scrupulous that they meet all specifications.

VISION

"We aim to be among the top 5 global companies as a preferred impregnation sealant supplier for our customers worldwide."

MISSION

"We commit ourselves to growing this business by ensuring the quality of our products through conscientious research and development, total customer satisfaction and a caring work culture."

Do you know about
Teknoseal & Impregseal?

Founded by the Sen brothers in Pune, India, we are an organization of international repute in the research, design, and manufacture of state-of-the-art vacuum impregnation machines and sealants.

Dr. Resin

Our aim has been to provide state-of-the-art, cutting-edge technology in the impregnation process, at affordable prices.

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We are one of the few internationally acclaimed organizations involved in the design, manufacture, and research of state-of-the-art vacuum impregnation machines & sealants. We are the largest impregnation specialist in Asia and our products are under continual improvements backed by in-depth research at our technology center.

Our range of TSP sealants undergo rigorous tests in our laboratories, in accordance with global standards, such as Under Writers Laboratory USA-UL87, US Military – MIL I 17563C, and NSF International USA-ANSI 61, ARAI, Lloyds Register of Shipping London, UK.

We ensure that the quality of management system is in accordance with EN ISO 14001:2015. A plethora of major automobile manufacturers worldwide have also approved our sealants.

In Asia, we are pioneers in the production of impregnation systems, including fully automatic operator-less impregnation installations, which incorporate a completely flexible and programmable process cycle. We are reputed for maintaining our pledge: 'Quality Cost Delivery'.

We are aiming to become one of the top five global vacuum impregnation companies Research and Development (R&D) and manufacture of high-technology impregnation machines and sealants, which find use in sophisticated domains such as Defense Standards, Automotive, Electronics, Communication Systems, Avionics, and Aerospace.

Our team consists of top technical experts in the field of Impregnation technology. Since 1983, we have accrued four decades of rich experience in the intricacies of the process of vacuum impregnation. Our premises boast of state-of-the-art infrastructure and facilities.

We ensure that our customers get maximum Return on Investment. Our production facilities and R&D boast of providing comprehensive investigation and handholding during project conception. We ensure to implement the relevant requirement understanding and comprehensive investigations so that the relevant data can be provided to the customer, who can achieve optimum results in plant selection and process design engineering. All of this comes to the customers at no additional cost.

What are the hurdles for effective **impregnation?**

"The sealant might not penetrate into the porosities."

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"The sealant might get into the porosities, but the process control may not be right."

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The surface of components and porosities must be clean and dry

Before impregnation, the component and the porosities must be clean and dry. The component must be washed and dried after machining. At this stage, the porosities might have cutting oil, water, or other contamination. To nullify this, the component must be dehydrated or heated. in a suitable oven at minimum 150 degrees Celsius.

The rule of thumb is to heat a cross-section of one millimeter for 30 minutes. For extremely thin components, a shorter duration of time is recommended.

An alternative to ensure cleanliness of the component surfaces is a vapor degrease, is effective for a minimum of 30 minutes in perchlorethylene. However, due to environmental hazards, it is not recommended.

In case of specific alloys that may get distorted due to heat, the remedy is to wash them clean in a hot industrial wash, rinse, and vacuum dry them while they are still hot. This method is effective in cleansing porosities despite the existence of high volatile oil contamination.

Now, both the components and the porosities are conducive for the sealant to penetrate into the porosities.

In some cases, where the porosities are not cleaned completely (partially filled with contaminants), the sealing is not complete

Now, the sealant near the component surface results in a good sealing performance. However, in the interiors, the blend with the contamination may result in partial polymerization of the sealant, thereby resulting in inproper impregnation leading to leakage, even though the component had passed the initial pressure test.

A polymer of a contaminated sealant is proportionally weaker than a polymer of a pure sealant. The components will pass the initial pressure test, but might fail while in operation. Consequently, customers are led to believe that the sealant has failed. The point is that the pre-treatment of the components is to be blamed, not the sealant itself.

What **temperature** can methacrylate sealants withstand?

The rate of breakdown varies as per the temperature it is subjected to and the duration of exposure at this temperature.

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Every methacrylate sealant is associated with a specific temperature beyond which it undergoes a breakdown.

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Methacrylate sealants have a specific working temperature

A polymerized sealant normally fails above a specific temperature. It is important to remember that all methacrylate sealants have a similar working temperature. It carbonizes and deteriorates and becomes more brittle and crystalline. Its volume shrinks, thereby causing leaks through which fluid and/or air can pass.

Let us consider a sealant of a working temperature of 200 degrees Celsius. Exposure to 225 degrees Celsius will require a very long duration for deterioration, but exposure to 400 degrees Celsius will result in quick deterioration.

The porosity complexity (type, size, and depth) also affects deterioration. Thus, a long, thin, and deeply-seated micro porosity is less prone to failure than a large, shallow, and superficial porosity.

Another case could be that if one side of the casting is heated to 280 degrees Celsius, the sealant in its proximity begins to deteriorate. However, if the other side is heated to 180 degrees Celsius, the sealant is secure.

When a sealant enters porosity, it gets polymerized. In case of all methacrylate sealants, when they enter porosities, the polymerization results in shrinkage. In our TSP range of sealants, the magnitude of this shrinkage is far lower than other sealants in the market.

Moreover, our TSP range of sealants has been designed for greater adhesion to the porosity surfaces, thereby further reducing the effect of shrinkage in the porosity. Consequently, the slight shrinkage does not interfere with the integrity of the sealed components.

What **size of porosity** can be sealed?

> Our range of sealants has the unique properties of flow, wettability, and adhesion to seal a wide range of porosity sizes.
>
> **Dr. Resin**

> Vacuum impregnation can normally seal micro and macro porosities in castings and cannot seal (does not cover) major casting defects such as blow holes and cracks.
>
> **Dr. Impregnator**

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Porosity sizes and sealability

Porosities can be micro or macro in size, which causes gas or fluid to pass through them. The impregnation process is only for such porosities and not for major casting defects, casting cracks, and large-diameter blow holes. A porosity is like a cobweb structure and not a through-hole. So, it is tough to define the porosity size that can be sealed. A rule of thumb is that a porosity of size 300 microns can be sealed.

However, a porosity of more than 300 microns can also be sealed depending on the stucture of the metal and nature of the porosity. The porosity size that can be sealed depends on the method of retaining the sealant in the porosity. In case of large porosities, some procedures exist to retain the sealant.

If an impregnation chamber is completely filled with sealant and heated, the sealant will polymerize into a hard plastic of two meters' diameter. However, we do not need to seal porosities above two meters in diameter as they never exist.

For some unusual procedures typically used to hold sealants in porosities for high-value, low-volume applications, please contact our team on +91 9763707208 and we shall be pleased to advise you

Porosity sizes that should be sealed

Vacuum impregnation does not alter the mechanical strength, structure, shape, size, dimensions, or appearance of a casting. In most cases, the customer can decide whether a component is made weak by a casting defect, if a casting defect has an impact on the casting's mechanical properties, and if the casting should be impregnated and used.

The customer should decide whether porosity is detrimental to the mechanical structure of the casting, and the effect of the porosity on the casting soundness in terms of size and shape. Impregnation is not for cosmetic appearance.

What types of components can be **impregnated?** What pre-treatment is essential for these?

Components with micro and macro porosities can be impregnated. Castings that have blow holes or spongy areas cannot be impregnated.

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The pre-treatments are oven drying, vapour degreasing, or industrial wash.

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Types of components that can be impregnated

By virtue of the technique of the impregnation process, only those components that have inherent porosity fall under the purview of impregnation. Therefore, components that have blowholes, cracks, and spongy metal structure cannot be impregnated. An indication of the nature of porosity in the component is sometimes exhibited by the leak rate (cc/min).

If the component has an uncertain leak rate and a high component value, then before scrapping and replacing the component, one should do impregnation and testing. To assure efficient use of process equipment, one should aptly select components prior to impregnation.

If components are leaking in the as-cast state and further machining will not increase leakage, impregnation should be carried out in the as-cast state. It is not recommended to do impregnation three or more times on a component unless the component structure can handle the casting's service conditions. Before a component is subjected to impregnation, all structural repairs must be completed.

Some metal castings are welded for repair. During welding, some porosities may arise, and these can be impregnated. After impregnation, if welding is implemented, this can result in a thermal breakdown of the sealant. The sealant might gas out of the porosity, and this can cause subsequent leakage at the weld.

Pre-treatment

The pre-treatments are oven drying, vapor degreasing, or industrial wash. This is followed by oven or vacuum drying. The components must be cooled to less than 25 degrees Celsius before impregnation.

The motive of pre-treatment is to make components dry, clean, and free from foreign matter. If wet components are impregnated, the sealing performance is affected, and the sealant and the vacuum pump efficiencies are also decreased.

Prior to impregnation, if components are contaminated with oil, this is very harmful. Glycol-based oils and mineral oils are the toughest to remove when the components are pre-treated.

Process Preparation?

Sealant Degassing and Basket Packing?

"Sealant degassing is the process to remove moisture from the sealant bath as well as induce oxygen into the sealant bath for stability."

Dr. Resin

"Basket packing is the proper placement and orientation of the castings. It plays an important role for a good sealing result to be obtained from the process."

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The Sealant Degassing process

Sealant degassing replenishes oxygen in the sealants and discards contaminants such as solvents and water. This results in enhancement of pot-life stability. It also helps to agitate the sealant once a day for ensuring good mixing of the catalysts in the sealant thereby avoiding any possibility for the catalyst to settle.

The sealant transfer process is also an efficient degassing process. Sealant degassing involves removing moisture from the sealant and inducing oxygen into the sealant bath for stability. Due to the vacuum during the transfer process, it helps remove the moisture from the sealant bath and also implement air purging of the sealant.

The optimum time for sealant degassing is during a weekend or when production has been temporarily stopped. If production has stopped for more than three days, sealant degassing must be ensured on a daily basis. The sealant must never be exposed to heat. Catalyzed methacrylate sealants should be stored at temperatures of less than 20 degrees Celsius.

During sealant degassing, the autoclave lid must be completely closed. At other times, it may also be partially/completely open as sealants remain stable in the presence of air. It is recommended to transfer the sealant to and from the storage vessel at least once a day.

The Basket Packing process

The proper packing and orientation of the castings in the basket play an important role in a good sealing result. Good basket packing ensures deposit-free and stain-free machined castings, post-impregnation, and also ensures optimum consumption patterns.

Some important points to achieve good basket packing are as follows:

Orient tapped and drilled blind holes horizontally to optimize sealant consumption, prevent resin retention in the holes after draining -thereby avoiding resin deposits- and eliminate the possibility of heat marks in the event of a steam entrapment

Remember that airlock or air entrapment during the impregnation process will impede sealing and for fully machined castings, use nylon/ plastic separators or designed fixtures to protect the machine surfaces from dents and damages

What are the steps in an **impregnation process?**

The initial steps are loading of the basket in the impregnation chamber, dry vacuum, wet vacuum/ pressure cycle, and penetration of sealant into porosities.

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These are followed by the atmospheric pressure soak, followed by the draining, washing, and hot cure cycles.

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The Dry, Wet/ Pressure Impregnation Cycle

The sealant storage vessel is filled with sealant. The basket comprising components is placed in the autoclave. The impregnation chamber has a dry vacuum of 3–8 millibars for the dry cycle time. The dry cycle time can be six minutes and more depending on the configuration of the castings and wall thickness, etc. While the autoclave is under vacuum, the transfer valve is opened., and the sealant flows into the autoclave. When all the components are immersed in the sealant, the transfer valve is closed.

The vacuum is continued further. This is called wet vacuum. The wet vacuum cycle time could be one minute or more, depending on the process cycle required for the specific component. Now, the vacuum is released, and the pressure in the autoclave is normalized to the atmospheric pressure.

The components are soaked at atmospheric pressure while the impregnation chamber lid opens. Now, a vacuum is applied in the storage vessel, and the transfer valve is opened. The sealant gets drawn back to the storage vessel.

For certain components, the autoclave is maintained at a pressure of 3–4 bar for 6 minutes or more depending on the process cycle for the specific component. This is termed as the pressure cycle. The components are tested for very fine porosities for Helium, SF-6, and Nitrogen, etc. After this cycle, the sealant is returned to the storage vessel. This marks the completion of the dry, wet/ pressure impregnation cycle.

Sealant drainage

Post-impregnation, sealant drainage is implemented. The impregnated components are moved from the autoclave to the drain station. Here, the excess sealant is drained and transferred to the storage vessel.

The basket of components is tipped and rotated. The basket is rotated in the drain station four times. Typically, the basket is in the drain station for a period almost equal to the time in the autoclave. More the time spent in the drain station, more is the sealant drain. The approximate duration is 15–20 minutes, which is determined by whether the pressure cycle was used or otherwise. To improve drain, automated centrifuges and rotary drains are used. Casting orientation is of prime importance for an efficient drain.

What are the cold wash and the **hot cure processes?**

> The cold wash process implies immersing the basket in a cold wash tank to wash the sealant from the casting surfaces.
>
> **Dr. Resin**

> The hot cure process implies immersing the basket in a hot water tank maintained at 90 degree Celsius.
>
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The Cold Wash cycle

After the drain cycle, the basket is moved to the cold wash tank where the sealant adhering to the casting surfaces is washed. An overhead hoist agitates the basket, and an air purge system assists washing. Reciprocating or rotational washing is advisable for machined components to assure absolute cleanliness.

The water temperature must be more than 15 degrees Celsius for efficient washing. To prevent discoloration of components or oxidation, inhibitors can be employed. The cold wash tank cycle would depend upon the type and material of the component. we must ensure that the cold wash water is reasonably clean to ensure efficient washing of the components. Normally, it is recommended not to exceed more than eight percent of contamination in the wash water. The BRIX method can be used to monitor the same.

To nullify contamination of the tank due to sealants, it is emptied intermittently or a continuous top-up, post-processing or during processing is performed dependent on the local water treatment requirements, production volume, and component type.

The Hot Cure cycle

After the cold wash process, the hot cure process is applied. The basket is immersed in a hot water tank maintained at 90 degrees Celsius. For removal of air pockets in the components, the basket must be lightly agitated on an overhead hoist 3–4 times. This will prevent the possibilities of heat marks. The water temperature must be maintained at 90–92 degrees Celsius before the basket is immersed. The duration of this process is approximately 10–20 minutes.

In case of light alloys, long cycle times can darken these. Additives can be used to decrease discoloration after due consideration of components and the chemical features of the water. For copper-based alloys such as ADC 12, it is advisable to maintain a temperature of less than 90 degrees Celsius to prevent discoloration of the castings. It is recommended to empty the hot water tank and replace the water when contaminated from time to time. Any solid residues should be removed during the cleaning process.

How to **ensure good results** of impregnation?

Adherence to strict process control is essential.

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Component cleanliness and monitoring sealant quality are of prime importance.

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Process control for good impregnation results

The process parameters such as vacuum level, hot cure temperature, hot cure water pH levels, sealant degassing, and sealant tempeature, cold wash tank water quality must be up to the mark.

For sealant quality monitoring, out of the several chemical tests, the gel time of the sealant is of prime importance. The frequency of the test should be once per day. If the plant is used 2 or 3 times per month, the test must be each time before the plant is used. A general recommendation is to perform the test once per week.

One of the methods to check the efficacy of the impregnation process is to use a test piece of known porosity. Usually, the test piece is a sintered metal test ring manufactured in iron or aluminum and has porosity percentage ranging from 15 to 25 percent.

Dos and Don'ts for effective impregnation

To ensure good process control, please observe the following:

- Ensure that the impregnation process is carried out at a vacuum level between 3-8 mbar
- Do not wash with cold wash water temperatures lesser than 15 degrees Celsius: The optimum temperature range is from 20 to 30 degrees Celsius. In case, the water temperature is below 15 degrees Celsius, increase the washing cycle time.
- Do not neglect the basket packing. If it is loosely packed ensure that the components do not dent each other by using appropriate separators (avoid mechanical damage)
- Do not allow the basket to be immersed in the wash solutions for a very long duration
- Do not cure at hot water temperatures less than 88 degrees Celsius
- Do not impregnate if the sealant bath is contaminated
- Always avoid flat, close-fitting surfaces of components to be adjacent to one another
- Prevent oily or wet components for the impregnation cycle. Components must be clean and dry prior to impregnation.
- Maintain process control of pH values in hot cure water tank to avoid discoloration of components

What pressure can an impregnated **component can endure?**

> The pressure that an impregnated component can endure is the pressure for which the component is designed.
>
> **Dr. Resin**

> Impregnation does not increase or decrease the strength of the parent material.
>
> **Dr. Impregnator**

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The maximum pressure that an impregnated component can endure

A non-leaking casting that is not impregnated and an impregnated casting should ideally bear the same maximum pressure. We must remember that impregnation seals the leakage path and therefore seals the leakage in the casting. However, it does not enhance or decrease the strength of the casting. As an example, castings have been tested for pressure resistance, post-impregnation, until 1,000 bar and higher.

Impact of the casting type on the maximum pressure an impregnated component can endure

It should be kept in mind that castings of the same design vary in the volume, shape, and size of porosities. So, each casting is different. Consequently, one cannot define test parameters that can conclude a definite result regarding the pressure an impregnated component can bear. This maximum pressure depends on the casting design, and therefore, all castings after impregnation may be tested for the design pressure.

If an impregnated component fails, how does failure occur?

There are two possibilities. Due to contaminants present in the porosity, or the media such as gas and/or water can squeeze its way between the polymerized sealant and the porosity wall. This would primarily depend upon two factors:

- The shrinkage of the polymerized sealant
- The adhesion property of the polymerized sealant with the parent material This especially happens in the case of castings tested with inert gases such as Helium, Nitrogen, SF-6, etc.

An effective way to check these properties would be to take a gel test in a glass test tube. Moreover to minimize the possibility of failure, cleanliness of porosities is mandatory. Only then, the sealant can perform efficiently.

At what temperature should **catalyzed sealant** be stored?

The impregnation sealant being a thermocuring sealant, storage temperature and sealant aeration are of prime importance for storing catalyzed sealant.

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The maximum temperature at which the catalyzed sealant can be stored is 20 degrees Celsius.

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Procedure for storing catalyzed sealant

The temperature of the catalyzed sealant storage should not exceed 20 degrees Celsius. Some companies have a cool area within their premises. Others have cooling systems. Due to exposure to sunlight, the sealant temperature can rise. Ultraviolet radiation can also affect the sealant. So, the sealant must be kept away from direct sunlight.

Storage procedure

When the impregnation machine is under shutdown, it is essential to keep the cooling system ON so that the sealant temperature is always maintained between 15-20 degrees Celsius. Further, it is advisable that during shutdown for more than three days, sealant transfer must be ensured on a daily basis. In case of catalysed methacrylate sealants, these should be stored at temperatures of less than 20 degrees Celsius.

During sealant transfer, the impregnation chamber (autoclave) lid must be completely closed. After the process, it may be partially or completely kept open. The reason is that sealants remain stable in the presence of air. The sealant transfer should be at least once a day.

When the catalyzed sealant has to be stored in drums, then ensure that the drums filled with catalyzed sealant are kept at temperatures less than 20 degrees Celsius or in an air-conditioned room. Ensure that the drums are not filled right to the top and there is an air gap of 10% by volume at the top of the drum. Further, you should open the lid of the drum at regular intervals (weekly once or twice) and purge dry compressed air into the sealant.

The Shelf life of a stored catalyzed sealant

In case the catalyzed sealant is being stored in drums, the shelf life would be approximately 12 months (provided the storage temperature is maintained at 20 degrees Celsius or less), after which its gel time cannot be assured. If a catalyzed sealant is stored for more than 12 months, the sealant must be checked for its gel time and viscosity, etc. before use.

How important is **catalyst addition?**

> In order to ensure sealant polymerization, the sealant must be catalysed.

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> Castings impregnated with uncatalyzed sealant cannot be sealed.

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TSP 99 Impregnation Resin Catalyzation

When the TSP 99 impregnation resin is heated to more than 90 degrees Celsius, it polymerizes into a gel provided the catalyst has been added.

The relation between gel time and catalyst volume

The gel time has an ideal range of 2–7 minutes. The advisable range is 2–3.5 minutes. If you want a gel time of less than two minutes, the catalyst concentration must be enhanced. If you want a gel time of more than five minutes, additional catalyst must not be added. For catalyst powders, the rule is to add catalyst at a rate of 0.2 percent of the weight of the fresh sealant. This would normally give you a gel time between 2 to 3 minutes. Over a period of time, the sealant bath gets contaminated and the gel time may go high. Under such circumstances:

- If the gel time of the bath is between 7–8 minutes, catalyst should be added at 0.1 % by weight of the sealant.
- If the gel time of the bath is above 8 minutes, catalyst should be added at 0.2 % by weight of the sealant.

Catalyst preparation before addition to the impregnation system:

In a PE or PP clean container or bucket, mix the catalyst and the sealant. Add the catalyst powder into the sealant in the bucket and stir well. The sealant volume must be five times the catalyst volume. Intermittently use a non-metallic stirrer for a minimum of 60 minutes to attain the end result.

Addition of the prepared catalysed liquid to the main sealant

Add this catalysed liquid to the remaining sealant. Slowly stir the sealant for a minimum of one hour to mix the catalyst completely in the sealant. Eventually, any particles should not be visible in the sealant. An effective way of stirring the sealant is to transfer the sealant back and forth from the storage vessel to the autoclave vessel for a few times.

Weight of catalyst to be added

The catalyst powder should weigh between 0.2-0.4 percent (as specified in the product data sheet) by weight of the sealant weight. This is a general rule but could vary depending upon the porosity to be sealed and the variety of sealant.

Is sealant **consumption optimized?**

Consumption of sealant would depend on plant design and cycle time.

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Consumption of sealant would also depend on the drainage property of the sealant (viscosity).

Dr. Impregnator

Consumption of impregnation sealant – an insight

The amount of sealant used primarily depends on the cycle time and the plant design. Batch impregnation machines with a fast cycle time (small draining cycle time) will have a higher sealant consumption when compared with a similar machine with a slow cycle time (higher draining cycle time).

The draining module also determines the draining efficiency. Teknoseal can help optimize sealant consumption by an effective balance between the draining method and the cycle time.

Sealant consumption is also dependent upon the draining property/drag-out of the sealant, that is, the sealant viscosity. A 10-15 percent reduction in viscosity results in consumption reduction by approximately 20 percent. The scientific way is to actually test the viscosity of the sealant with a Seta Zahn cup no. 1 and refer to the temperature v/s viscosity graph to determine reasons for change in consumption pattern, if any.

The key to decreasing the amount of sealant consumption is to select an impregnation sealant that drains effectively, a machine that has a multidirectional draining or centrifuges for draining, and/or a machine with increased cycle duration so that draining continues for a longer time.

The amount of sealant consumption is directly proportional to the carryover, which is proportional to the surface area of the component. Porosity filling is a minute proportion of sealant consumption compared to the surface area of the component. Post-impregnation, basic science can be leveraged to compute the amount of sealant consumption. Parameters affecting sealant consumption.

The sole method of determining sealant consumption is to run an impregnation system and monitor its performance. Every application is unique when the issue is of sealant consumption.

Out of a large number of parameters that have an impact on sealant consumption, some of the prominent are the following:

- Component characteristics: material, quantity, shape, size, porosity level
- Plant features: type, size, basket size, process fixtures, process control methods, type of draining and washing modules
- Production method: cycle time, quality control systems, production plans, operator efficiency
- Sealant draining properties: viscosity/drag-out properties

Statistics of sealant consumption

If you use our range of TSP 99 sealants in a fully operational impregnation plant with a centrifuge drain for a wide gamut of components for an adequately long duration, the approximate sealant consumption values will be the result. However, they will not precise values. They will alter with a change in the casting being impregnated, the physical size of the impregnation machine and its operational method.

Conclusion

The consumption of sealant depends on several factors, which change as per each application. There exist many claims pertinent to sealant consumption that are supported by calculations and the application type they are related to. Teknoseal can prove by furnishing several examples that its normal range of TSP sealants can efficiently perform draining and thus minimize sealant consumption.

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Our machines and sealants are manufactured to world class standards and our clients get the benefit of our accreditations with UL - USA, NSF - USA, Lloyds Register Shipping, ARAI, General Motors and many more.

- This ensures rigorous and detailed yearly and quarterly audits to ensure compliance.
- All batches manufactured are ensured of consistency in quality.
- Rigorous and detailed thermal and environmental and chemical resistance testing conducted as per international standards viz:USMIL 17563B & C.
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Is there a standard test piece for **process quality check?**

"The Teknoseal test ring"

Dr. Resin

"Test rings in conjunction with sealant parameters is the key"

Dr. Impregnator

The objective of the Teknoseal test ring

The objective of the Teknoseal test ring is to ensure process quality control. It is used to provide confirmation of performance.

The Teknoseal test ring has a consistent porosity structure. It has about 20% porosity that ranges from a very fine to a comparatively gross nature. The design of this test ring is such that it should pass through the impregnation system and then undergo pressure testing at 50 PSI air under water. During this air test, if the ring exudes the impregnant, it means that the impregnant lacks adequate amount of catalyst or the cure temperature is lesser than the recommended value.

We recommend that at regular intervals, the test ring should be included in the process payload, impregnated, and then subjected to Pressure testing immediately after removal from the hot cure oven. For this, the test ring is attached by wire or a loose fitting string to the payload at the commencement of the day. The impregnation, washing, and curing operations will be similar to the regular production. When the test ring has a leak rate that is more than grade 2, we advise that a full quality check is executed on the system.

Ring leakage occurs before problems are encountered with castings. So, processing can continue and simultaneously the reasons of the fault can be determined. Close attention should be paid to the recent gel test time and temperature trends.

Test rings in conjunction with sealant parameters are the key

The prime objective of a test ring is to develop a standard piece to evaluate sealants and also to check the efficacy of the process. The MIL specifications for the impregnation test rings are the following: outer diameter of 25 mm, wall thickness of 6 mm, and porosity of 15–25%. The length of the test rings is not important.

The hurdle in test rings is that if a sealant seals the test ring, it might not seal fine porosities in a casting or have good washability. The point here is that for sealing of gross porosity, a highly viscous (thick) sealant is required, while for sealing fine porosities, a less viscous (thin) sealant is required. Taking into consideration these facts, we recommend that the test rings should not be subjected to the cold wash tank. After impregnation, they must be directly immersed in the hot cure tank.

The impregnation of test rings in a machine is not easy. The reason is that in these test rings, the sealant that is close to the surface will wash out easily, which will result in leakage close to the surface. In order to overcome this, many sealant manufacturers propagate the use of non-standard test rings with wall thicknesses as high as 12-15 mm instead of the specified 6 mm. We, at Teknoseal, do not endorse any such testing using non-standard rings.

A common problem of test rings conforming to MIL specifications is that their porosity is in the range of 15–20%, which is more than any casting. Test rings are generally used for chemical testing. But, most porosities in castings are larger than the test rings. Thus, the results are not a good guidance. The porosity size in the test ring will also affect the Heat Stability test.

Test rings are merely an assistance to the impregnation process. They must be used along with other sealant parameters such as gel time and with the actual casting sealing performance. The background is that in some conditions the test rings can pass while the castings fail, while in some conditions, the castings pass and the test rings fail.

TAKING INDIA TO THE WORLD

Founded by the Sen brothers Saibal & Probal in Pune, India, we are an organization of international repute in the research, design and manufacture of state-of-the-art vacuum impregnation machines & sealants.

The management philosophy from inception has been to provide state-of-the-art technology in the Impregnation Process, Impregnation Sealants and Door Step Impregnation Services to the world market at the most affordable prices.

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