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OVER-MOLDING BEST CHOICE

YUNIOON'S 8 OVER-MOLDING SECRETS

> *"Over-molding is a process where a single part is created using two or more different materials in combination.*
> ***Yunioon** specializes in combination of rubber and metal."*

Technology is a world in constant evolution and it is moving ***increasingly faster*** as time goes by.

In this rapidly moving scenario, product performance requirements are getting every day more and ***more demanding***.

Over-molding products are offering ***outstanding solutions*** to improve several aspects of product design.

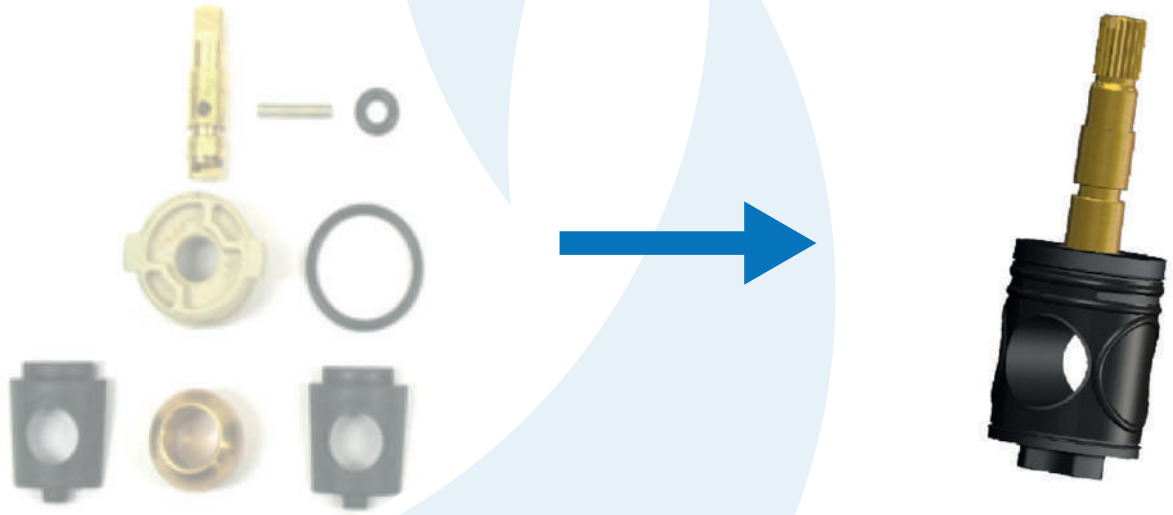
OVERVIEW

WHY CHOOSING OVER-MOLDED PARTS

Reduction of the number of components

- Lower sourcing cost, manufacturing cost and inspection costs
- Better quality from continuous improvements
- Reduction of inventory and lead time
- Procedures streamline
- Stronger long-term relationship

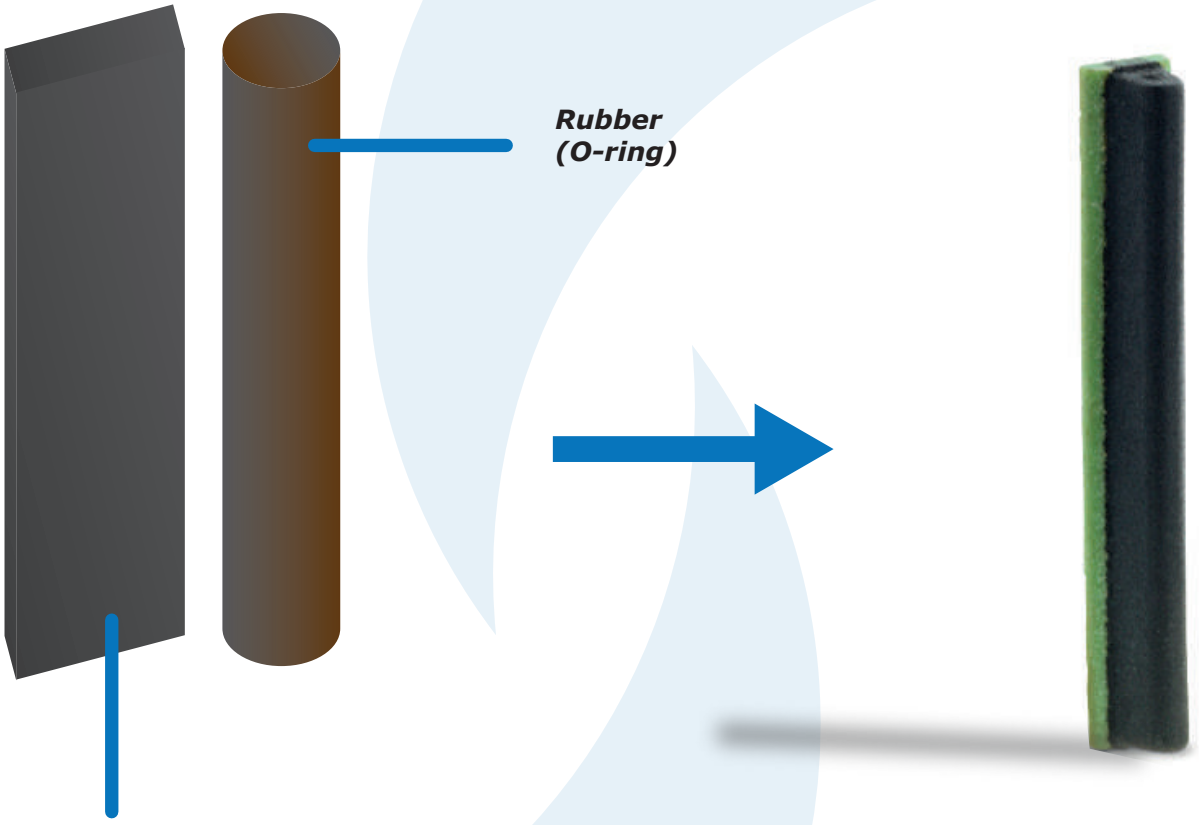
Example 1: Starting from an eight components ball valve, we designed **one single product**



Relevant product benefit of application:

- Parts inventory was reduced from 8 parts to 1.
- Suppliers number reduced from 4 to just 1.
- Brass usage reduced by 30%.
- Elimination of assembly operations, with quality nonconformities and cost reduction.
- Part cost was reduced by more than 60% (not including reduction of labor and assembly cost).

Example 2: For this specific product, a VOP (Variable Oil Pumps) for automotive application starting from an old two components solution, we have developed a PA66/FKM over-molded solution producing several benefits.



Relevant product benefits of application:

- Direct-cost saving on part higher than 20%, even not considering other savings from the assembly on high volume parts.
- Power loss reduction due to friction decrease.
- Emission reduction.
- Component hysteresis reduction.

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1. EXPERTS FROM THE START

Before being a matter of design, it starts with the capability of *thinking about effective and viable over-molded solutions.*

We revolutionized the design process.

Practical thinking begins at the very early stages of development. ***Our clients are put in contact with our over-molding experts since the very start.***

By sharing your product design with our experts on the first product steps, they will be able to support you, saving precious time, always crucial in product design and costs.

We focus on developing over-molded products hand in hand with our customers. Even prior to jumping into production, we dedicate time to ***talk, analyze and explain*** to them all issues concerning all ***rubber products***.

Get your design support today, book your FREE 30-minutes call with our over-molding experts, don't lose the chance to make the right first step for your product.

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2. INSERT CLEANLINESS AND HANDLING

Our customers' ***contamination specifications*** are getting more and more severe, in terms of contamination mass and volumes, and also in terms of particle distribution and type.

Dirty metal insert can have a ***negative effect*** on rubber bonding. Oil deposits, for example, lead to poor bonding and early detachment on the finished product.

It is mandatory to ensure ***proper component cleaning*** prior to any other over-molding step. Every insert will be washed in a machine with the appropriate washing fluid to the specific material compound, in order to obtain the best cleaning results.

Surface cleaning and preparation is also a crucial step for the success of the coating.

*All our guidelines for contamination avoidance are listed in our Technical Bulletin "**Cleanliness requirements on rubber products**" viewable at https://www.tumedei.eu/technical-bulletin*

In addition to cleaning machines, another fundamental step in contamination prevention is provided by our automated insert handling, ***avoiding human insert handling***.

The benefits are:

- Insert handling contamination reduction
- Insert handling loading costs reduction
- Insert handling damages reduction

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Test object

Identification	Metal Part
Part number	P 1509500
Batch number	clean #2
Sampling	shipping department, 19.04.2017 Entrance at RJL
Delivery	transparent bag, closed
Area extracted	complete
Number of Samples	10
Surface area	43.2 cm²
Volume	-
Test directive	ISO 1501, see attached page 6

Length-number histogram

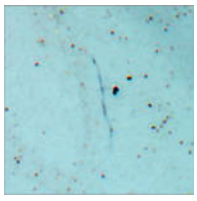
Frequency scaled, not cumulated

Number per length class (µm)	Total Σ	[15; 25)	[25; 50)	[50; 100)	[100; 150)	[150; 200)	[200; 400)	[400; 600)	[600; 1000)	[1000; 1500)	[1500; 2000)	[2000; 3000)	[3000; ...)
Granules matt*	117388	81551	28936	6112	718	24	47	0	0	0	0	0	0
Granules metallic glossy*	1900	672	880	209	139	0	0	0	0	0	0	0	0
Fibres matt*	71	0	0	0	0	0	47	0	0	0	24	0	0
Fibres glossy*	0	0	0	0	0	0	0	0	0	0	0	0	0
Particles in selected classes*	119359	82223	29816	6321	857	24	94	0	0	0	24	0	0
tolerable particles	-	-	-	-	0	0	0	0	0	0	0	0	0

Component cleanliness code* (CCC) A (C17/D15/E13/F10/G5/H7/I00/J00/K00/L5/M00/N00)

Sedimentation number* 662297 / (1 h x 1000 cm²)

1) Fibre, matt (biggest particle)
Length 1635 µm, Width 15 µm



1500 µm

2) Granule, matt
Length 320 µm, Width 77 µm

500 µm

3) Fibre, matt
Length 275 µm, Width 38 µm

500 µm

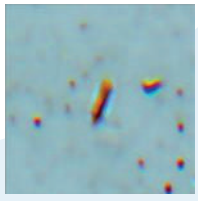
4) Fibre, matt
Length 212 µm, Width 24 µm

500 µm

5) Granule, matt
Length 200 µm, Width 90 µm

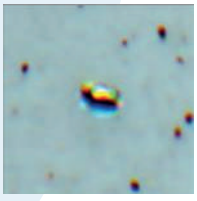
500 µm

6) Granule, matt
Length 166 µm, Width 46 µm



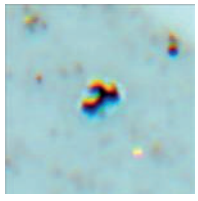
500 µm

7) Granule, metallic glossy
Length 144 µm, Width 87 µm



400 µm

8) Granule, matt
Length 140 µm, Width 90 µm



400 µm

The main unknown faults that lead to debonding issues and quality recalls on finished products are insert contamination and poor cleaning processes. Our process ensures the ***best possible bonding efficiency***.

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3. INSERT PREPARATION

The tradional way

BLASTING

This is an essential part of the insert treatments and in the early days it was synonymous with sandblasting but nowadays this is not enough.

Problems of sandblasting:

- Insert distortion and excess of rubber flashes after molding
- Unwanted coating removal leading to insert in-service corrosion
- Process instability; sandblasting is also very sensitive to the process set-up
- Contamination

CHEMICAL SURFACE TREATMENT

We have developed this process during last 10 years and successfully implemented it in our plants for this long. The chemical treatment allows to eliminate the use of sandblasting on this critical process step.

This process reduces, but not fully extinguishes, the risk of contamination while ensuring effective insert activation for bonding operations.

The Yunioon way

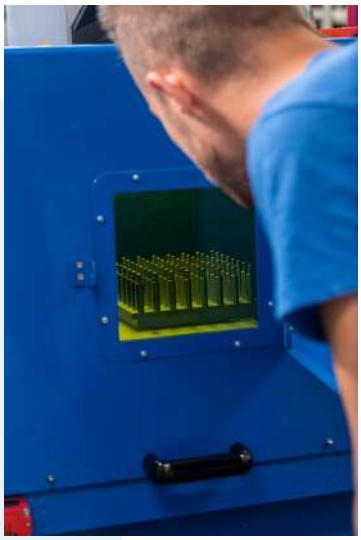
LOCAL MICROBLASTING

This ***game changing technology*** allows us to get all the advantages of sandblasting while eliminating all the problems connected with the old process.

During the last 2 years, our experts have developed, tested and approved this new, ***revolutionary process*** that put our company ahead of the competition in the insert preparation technology.

It mechanically removes physical contaminants that may be present on the metal parts and increases the surface's roughness, therefore increasing the contact area between metal and rubber.

This ***new and unique process*** ensures the best metal insert surface preparation.



The advantages of this new process are:

- Process stability, no manual influence on surface treatment
- Possibility to use thin inserts, avoiding any distortion caused by sandblasting
- Reduction of rubber flashes
- Incorrect coating removal
- Elimination of insert service corrosion
- Elimination of possible contamination due to sandblasting
- Cost-saving avoiding corundum usage

Book today your 30 minutes FREE consultation with our experts to choose the best insert preparation process for your new product.

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4. ADHESIVE SELECTION & APPLICATION

Adhesive selection

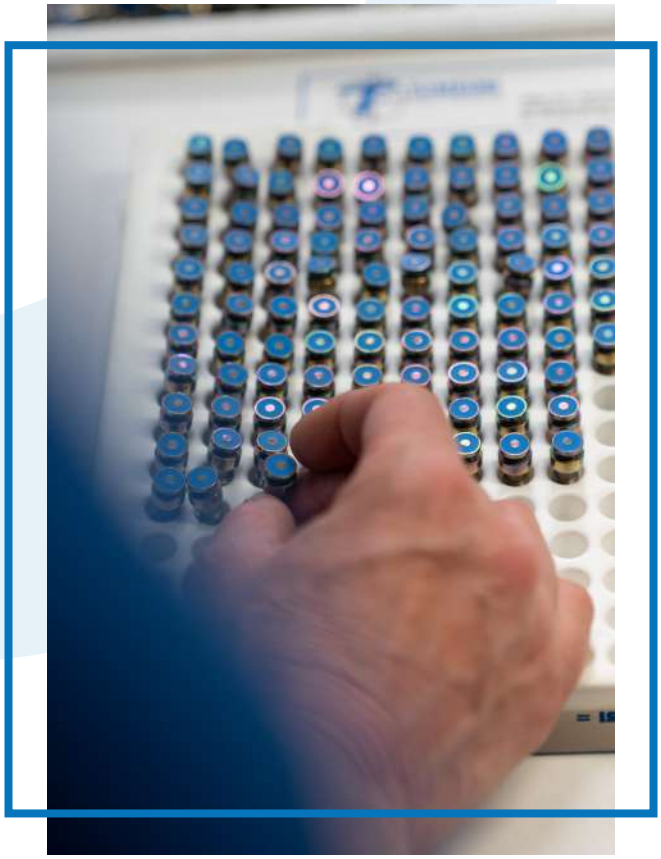
Using the wrong adhesive is one of the first leading causes of rubber to substrate bond failures. This will cause performance issues or, worst-case scenario, complete bond detachment.

In order to ensure a ***long bonding service life***, you need to use the ***proper adhesive*** compatible with chosen materials. The presence of additives and fillers inside the compound together with particular inserts' surface treatments can reduce chemical interaction of the substrate in over-molded products.

Choosing the right adhesive is a ***must***. The right product creates the best bonding behavior and product performances avoiding failures while ensuring long service life.

At ***TUMEDEI***, we have developed a complete list of bonding agents suitable for all the major compound families used in *Automotive and general industries*.

Our team will assist you in selecting the proper bonding agent for metal for your unique application.



Adhesive application

Most companies focus solely on adhesive selection. We decided to take a step beyond that common approach, evaluating the adhesive ***deposition method***.

Problem:

- Many companies are still working with ancient technologies like insert deepening and/or manual painting.
- Manually painting millions of inserts is not a feasible option.
- It is extremely difficult for a person to paint with precision and reliability for 8 hours a day.

Solution:

Two different automatic adhesive depositions technologies to ensure:

- Precise local deposition avoiding overflow and flashes
- Precise adhesive volume eliminating debonding due to insufficient adhesive
- Controlled adhesive viscosity ensuring full cavity coverage
- Prevent impurities depositions
- Increasing productivity
- Maximum cleanliness and high quality in the deposition and absolute deposition accuracy and repeatability.

In order to ensure a reliable adhesive deposition we have implemented an ***in-process camera control*** that monitors the quality of the operation piece by piece.

Get a FREE 30-minutes consultation with one of our experts to solve you debonding issues.

It will be a pleasure to have you visiting us in our plant or for a virtual tour to share with you the advantages of our proposal, finding together the right solutions for your products.

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5. POLYMER IDENTIFICATION & SELECTION

Not all polymers are suitable for over-molding.

This point could sound like common sense, but from our experience, it is not something that can be overlooked.

Problem:

The majority of the low-cost compound used for O-ring production can not be used for a bonded application. This is the typical mistake made by companies trying to enter bonded products market, just thinking that keeping two materials together will be only a process issue.

Designing high quality compounds, like low-temperature FKM, that can be suitable for over-molded applications is not easy.

Solution:

In order to give an answer to the above question, Tumedei has internally developed a low-temperature FKM capable of fulfilling -40°C application requirements ensuring perfect bonding with a wide range of materials.

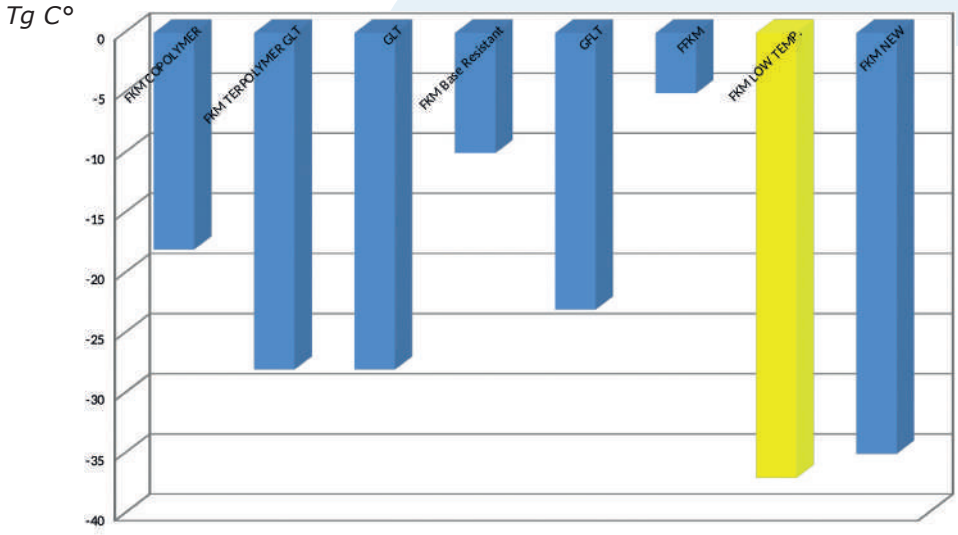
For more information about this material, get in contact with us asking for "***10030 material***", and we will support you in choosing the proper hardness for your application.

We also have a list of other compounds, internally designed and produced, for over-molded products capable of resisting to different fluids like hydrogen and fulfilling high demanding segments like medical flow regulators.

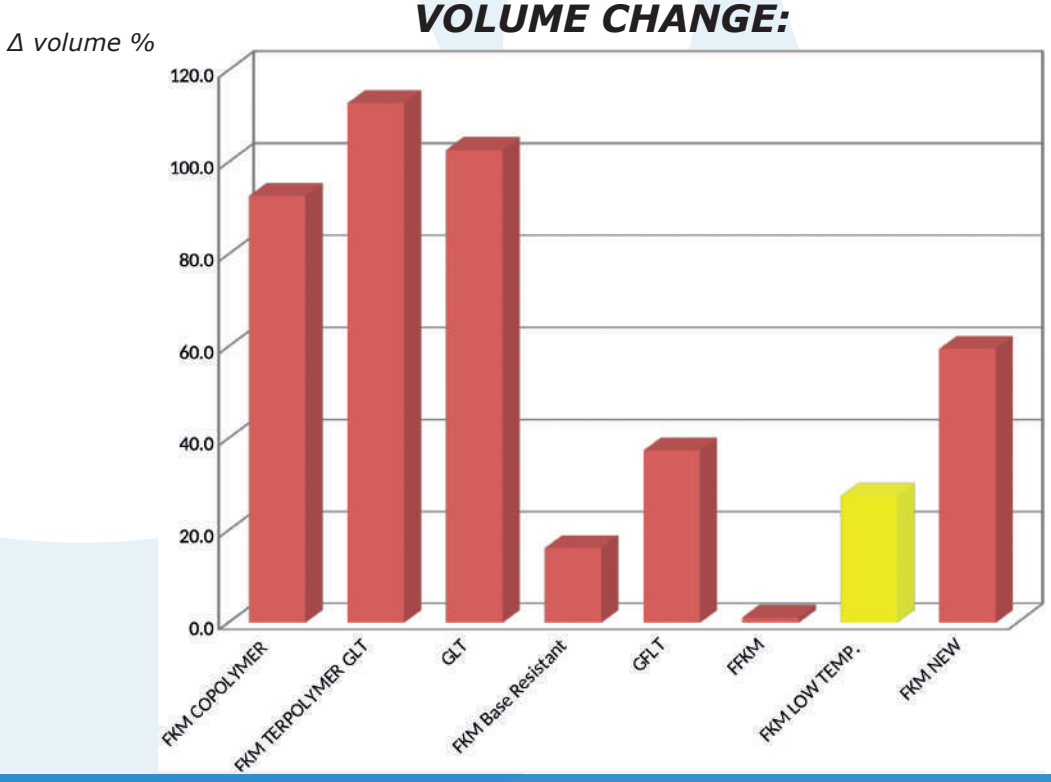
Example

Here below, highlighted in yellow, our 10030 low-temperature FKM characteristics compared to common fluoro-based polymers, in terms of low temperature and swelling in our aggressive testing media, showing how our 10030 compound can reach ***very low*** Tg temperatures ensuring low swelling in contact with aggressive fluids.

LOW TEMPERATURE FEATURES:



VOLUME CHANGE:



Book a FREE 30-minutes consultation with one of our experts, we will support you right material choice.

It will be a pleasure to have you visiting us in our internal laboratory with state of the art equipment managed by our skilled and expert technicians.

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6. BONDING PROCESS

The incorrect bonding process is one of the most common failure causes. Molding and curing processes play an essential role in ensuring a ***strong, reliable and long-lasting bond***.

Problem:

The molding method or the temperature and amount of time a coated insert is cured can have a direct impact on adhesion. For example, the exposure of coated inserts to mold-curing temperatures for an extended period of time before the rubber is introduced, this could potentially cause a detachment.

The same can happen with excessive adhesive exposure to air and high temperature or incorrect rubber flow inside tool cavities.

Rubber insert bonding has to take into consideration the behavior and interrelation of four different components, insert, adhesive, rubber and tool design at the same time; all of them have to react in a defined way with precise parameters to ensure product performances.

Here below an example of multiple material product, where inter-material bonding is fundamental:

Automotive centering bush

This is part of the drive shaft arrangement in a car. Only 3 companies globally sell this type of product

Solution:

Tumedei, thanks to its on-field experience, has developed internal processes and working instructions to ensure the ***best bonding interaction*** between wide material ranges.

Ask us more details about our bonding process experience;
we will be pleased to share with you our business cases and on-field experiences through our contacts.

Get a FREE 30-minutes consultation with one of our experts.

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7. SURFACE TREATMENTS

Problem:

There are cases where existing rubber compounds cannot meet the application requirement. In these cases, we can find out solutions adding surface treatment on rubber surfaces to solve specific topics.

A good example is the ***LPG/CNG applications*** where existing rubber compounds are not capable of ensuring a correct opening time and force at low temperature.

Solution:

Tumedei Anti Sticking Treatment (TAST)

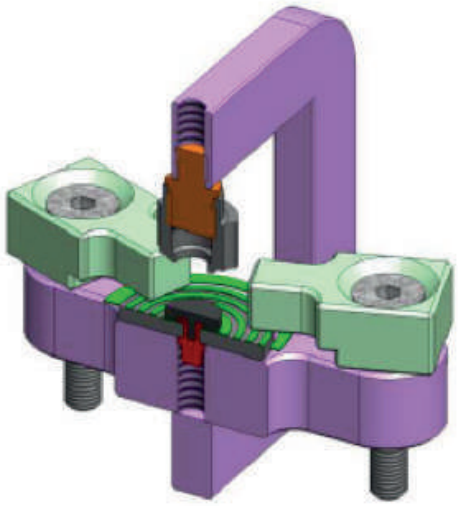
This process ensures correct injector opening time and force even at low temperature, giving the following benefits to our customers:

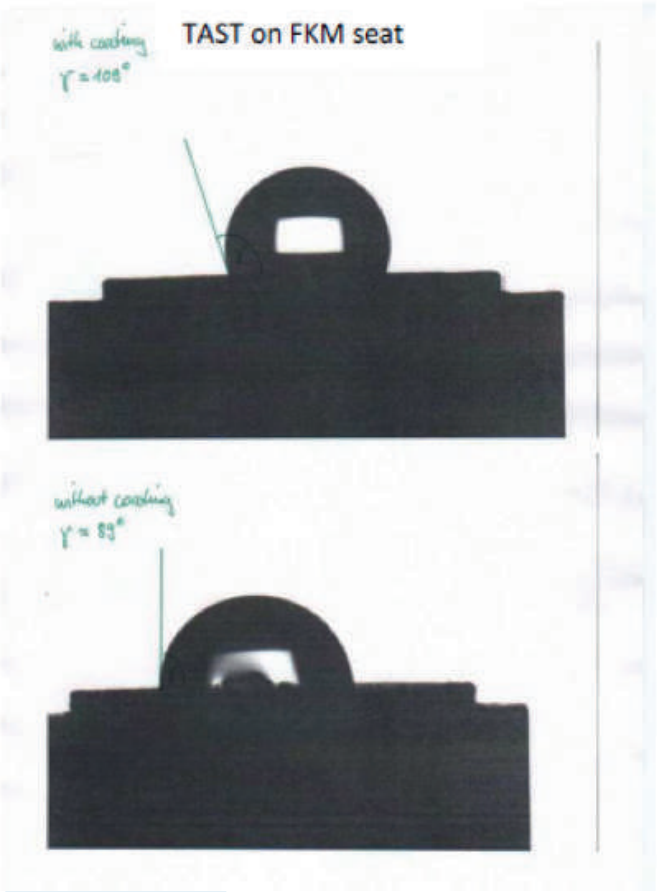
- No sticking after long inactivity; no slip-stick effect; no adhesion of elastomer to other parts
- Increase of low temperature performance of solenoid valve at temperature as low as -30°C (typically: decrease of open time and/or decrease of minimum oper temperature)
- Increase of repeatability of performance
- Reduction of friction
- Increase of lifetime of the valve
- Reduction of permeation with high molecular weight substances
- No modification of the bulk properties of the rubber is needed

Here below a typical ***TAST*** business case; you can discover all the details reading our Technical Bulletin "***Tumedei Anti-Sticking treatment***" available on our website:

(https://www.tumedei.eu/technical-bulletin).

Fixture for low temperature testing





TAST treatment is the right example of our over-molding expertise supporting customers in matching their product performances and making a step beyond, providing innovative solutions for current and future challenges.

Get in contact with us for more details about available and dedicated surface treatments suitable to solve your application problems.

Book a FREE 30-minutes consultation with one of our experts, we will support you right material choice.

It will be a pleasure to have you visiting us in our internal laboratory with state of the art equipment managed by our skilled and expert technicians.

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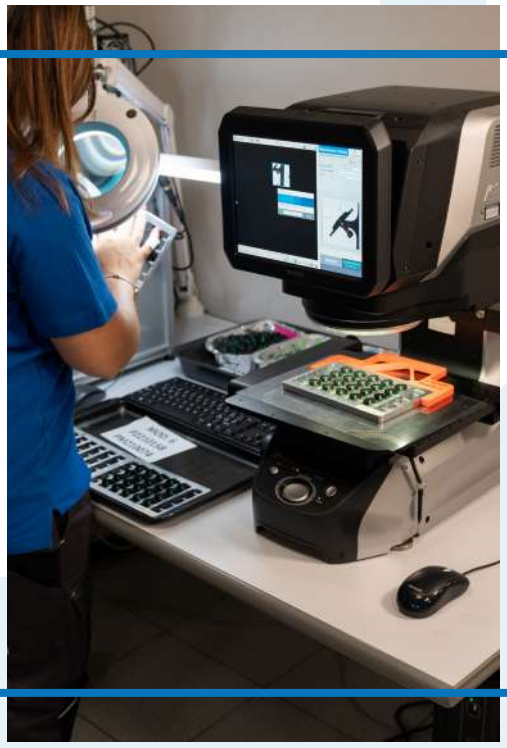
8. PROCESS QUALITY

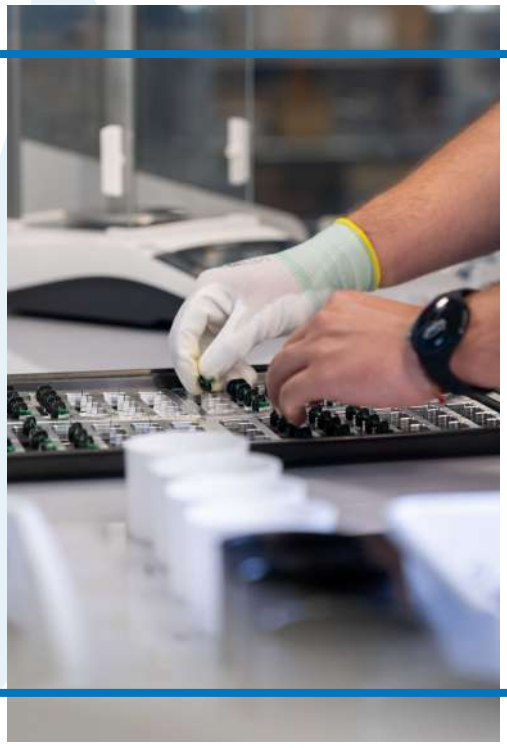
Processing quality and controls are critical points in the world of over-molded products.

A good quality system is the base to guarantee good process and high-quality products.
That is why Tumedei, in order to support its customers toward the "***zero-defect target***", has achieved the following ISO certifications: ***ISO9001- IATF 16949 – ISO 14001***.

We are continually improving toward further certifications.

You can get last certifications on
(https://www.tumedei.eu/quality-testing-certification/certifications/).





However, Tumedei's quality goes even further. We have developed a ***dedicated quality process*** that includes a 100% automatic, visual control and scrap part selection system designed for over-molded parts.

In combination with the above system, our quality system is capable of ensuring all the in-process controls necessary to guarantee an efficient manufacturing of good products to our final customers.

OUR QUALITY CONTROL MACHINES:

Tesa Visio, no contact measuring

Tesa Visio optical measuring device for rubber parts fitted with a Rhenishaw TTP for plastic / metal parts. Accuracy 3µm.
The measuring process can be programmed for the best repeatability.
It can also exchange files with Solidworks, allowing us to digitize parts.

Scanning DSC calorimeter

The Scanning Differential Calorimeter (DSC) measures the temperatures and heat flows associated with the phase transitions of the material.
It is commonly used for the investigation, selection, comparison and evaluation of material performance in research, quality control and production phases.

Get in contact with us for more details about our dedicated control system and quality procedures.

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CONCLUSION

With this document, we have shared all the major features that make our ***over-molding process unique***, giving our customers not only quality products but ensuring them to have ***the best solution*** for their over-molded products.

Our recipe for high performances over-molded products:

- **Internal product and tool design**
- **Internal compound design**
- **Specific insert preparation**
- **Bonding agent selection**
- **Polymer selection**
- **Internal workshop**

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Yunioon solutions enable our customers to solve the problems linked to multi-material applications.

With our products you can achieve benefits such as:

- ***Higher product performances***
- ***Reduction of component & supplier numbers***
- ***Elimination of assembly with one single component***
- ***Elimination of contamination thanks to our unique "microblasting" process***
- ***Elimination of poor adhesivation risk thanks to a dedicated automatic system***
- ***Optimal combination of different materials***
- ***Best over-molded product quality thanks to on-purpose processes and controls***

"WE FIND SOLUTIONS WHERE OTHERS FIND PROBLEMS"

TUMEDEI rubber engineering

GULF

Get a FREE 30-minute consultation with one of our experts to get the performance you need for your product.

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