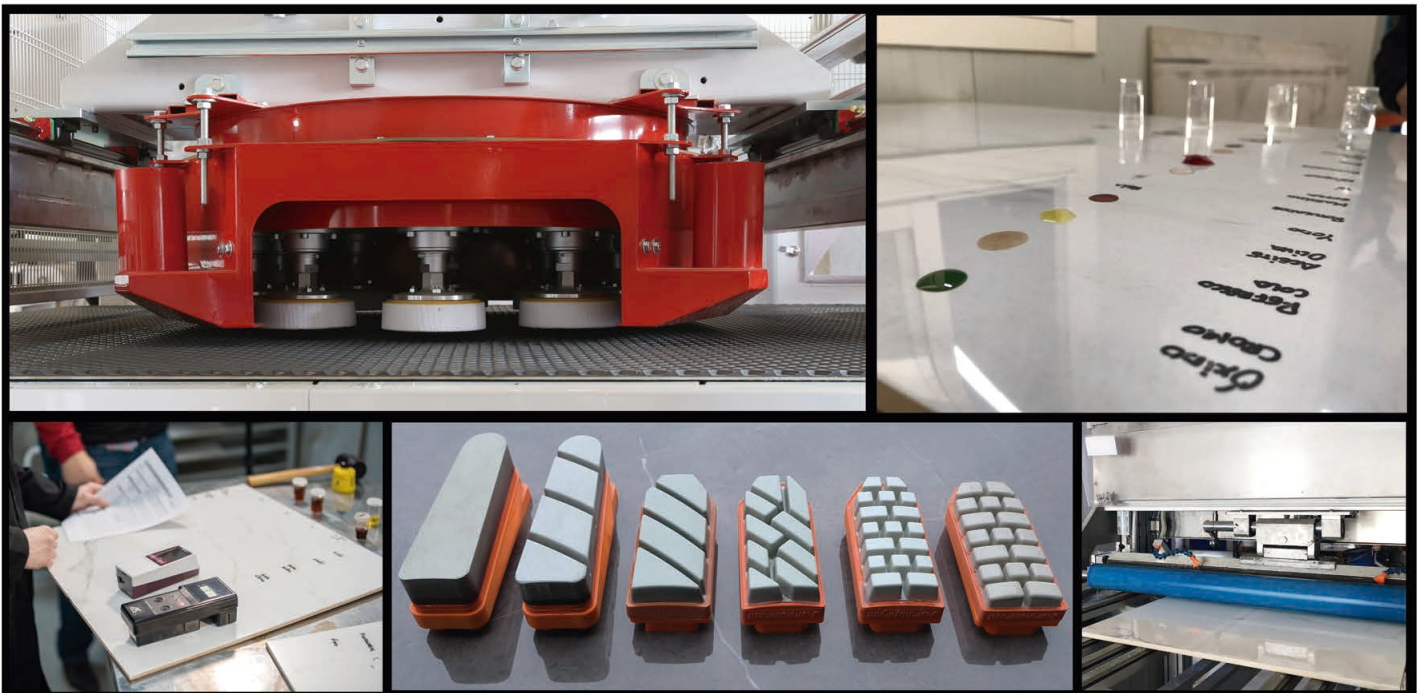




Technical Manual for Polishing and Treatment





1. OUR COMPANY:

- 1.1. COMPANY HISTORY.
- 1.2. CORPORATIVE VIDEO.
- 1.3. 

2. INFORMATION ABOUT POLISHING MACHINES

- 2.1. ACTUAL MARKET.
- 2.2. MAIN ASPECTS ON A POLISHING MACHINE.

3. DIFFERENT SURFACE MACHINING

- 3.1. FULL LAPPATO POLISHING.
 - 3.1.1. TYPES OF POLISHING
 - 3.1.2. BASIC PROBLEMS
 - 3.1.3. ADJUSTMENT OF SEQUENCE
- 3.2. LAPPATO.
 - 3.2.1. BASIC PROBLEMS
 - 3.2.2. ADJUSTMENT OF SEQUENCE
- 3.3. BRUSHING.
 - 3.3.1. TYPES OF BRUSHING.

4. SURFACE TREATMENT

- 4.1. DEFINITION.
- 4.2. TYPES OF TREATMENT.
 - 4.2.1. THERMAL-MECHANICAL.
 - 4.2.2. BRUSHING
- 4.3. SELECTION OF APPROPRIATE TREATMENT.

1. OUR COMPANY: SIGMADIAMANT.

1.1. COMPANY HISTORY.

SIGMADIAMANT was born 20 years ago with the idea to become a reference in the production and distribution of all kind of tools for cutting, squaring, polishing and chamfering of ceramics, natural and synthetic stones.

The success of our company is based on the continuous research of the best raw materials and services to be offering to our clients, providing the best performance and quality and with the best costs.

We develop our products in close collaboration with the main glaze manufacturers in order to obtain the best and updating range of products and materials, and with the latest trends.

Actually, SIGMADIAMANT have a customer base with the most part and most prestigious national and international firms and is present in more than 50 countries. We have an experienced network of agents and distributors in exclusive, which, together with our own delegation in BRAZIL and POLAND, moreover a large technical support team, allows us to provide a fast, excellent, and personalized services to our customers all around the world.

1.2. CORPORATIVE VIDEO.

Following, a video is shown where you can see the different locations of the company and our headquarters. Discover us !!!!

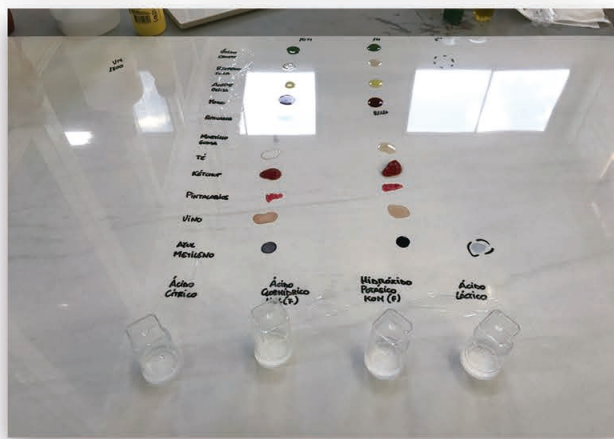


1.3. SIGMA LAB.

One of our main bets has been R&D. For this, we have our own technological laboratory, one of the top in our field, with machinery and resources that allow us to obtain and offer our clients:

- Continuous evolution of our tools, adapted to each material.
- Research for latest surface finishes trends, with the relevant tests to ensure the final quality of the product.
- Personalized confidential product development adapted to customer conditions.
- Control and treatment of ceramic pieces after development.

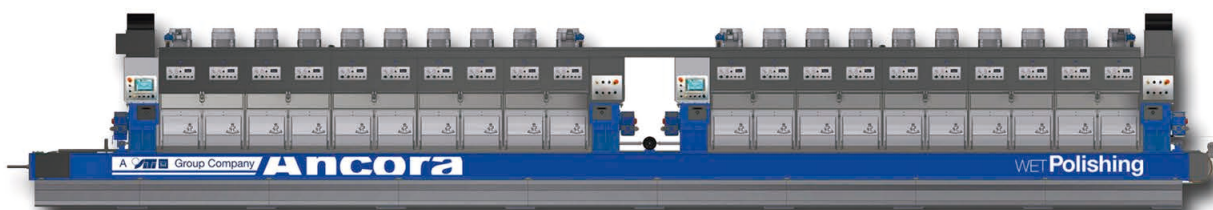
Come and visit our facilities:



2. INFORMATION ABOUT POLISHING MACHINES.

2.1. ACTUAL MARKET.

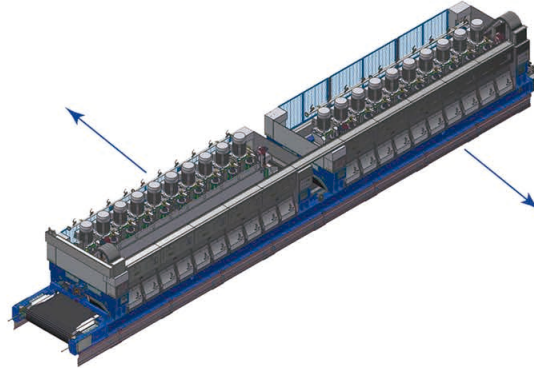
Here below this page shows some of the most demanded polishing machines today in the ceramic sector:



2.2.MAIN ASPECTS IN A POLISHING MACHINE.

Just before to study the main problems obtained during the polishing process, we would like to introduce the most important parts on a Polishing machine and the basic functioning.

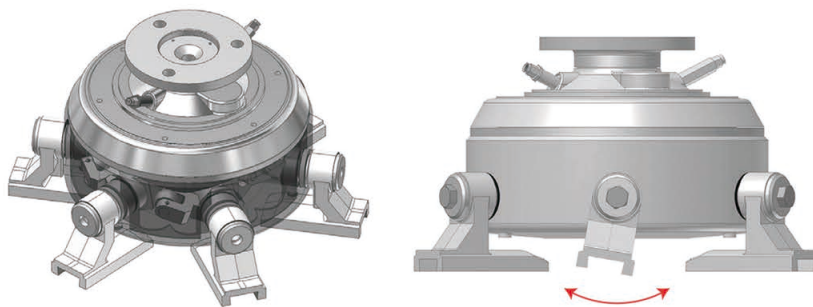
- Polishing machine bridge:



It is the upper beam of the polishing machine, where all the heads are attached. This part is responsible for distributing the pressure to all the polishing heads and is usually designed by using calculation programs to improve the dynamic response of the tilt movement.

The bridges can be single section or double, actually double are being the most used because they allow the speed of the transverse movement of the heads to be managed independently.

- Head:



Normally the head are 6 support pieces (or legs), but some rarely cases are 8. Generally, are with the fickert adapter and the satellites /circulars are not so common.

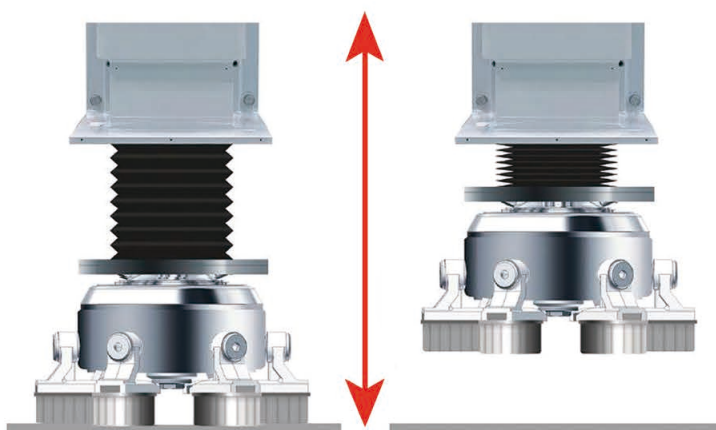
Oscillating legs are used to avoid deposits of material between the tool and the tile, keeping the processing system much more efficient

- Guides:

The guides are a metallic part situated on the lateral side of the polishing machine belt, in charge of holding the line in the center of the machine.



- Pressure and backpressure:



In the full lappato polishing, the processing must exert a greater force on the ceramic material. The pressure can reach up to 4 bar.

For lapping, the processing is less intense, we tend to use the main unit in back pressure, lightening the weight over the tile.

3. DIFFERENT SURFACE MACHINING

3.1. FULL LAPPATO POLISHING.

We call full lappato to the process that all the surface is over abrasion, being used a sequence of abrasives with different diamond granulometry.

3.1.1. TYPES OF POLISHING

Depends of the origin of the product we can distinguish the following cases:

- TECHNICAL POLISHING.

We will identify this type of polishing because they are made over the ceramic body.

This type of polishing is increasingly in disuse, because most part of the customers are changing to polishing full lapatto on glazes or micro grits, in order to obtain some technical improvements in the piece and be able to produce the full range of designs.

- POLISHING OF DRY GRIT.

Nowadays, when are polishing full lappato products with a dry grit application, we can find mainly two products:

- a) High grammage grit (is the one that commonly we called 2 kg/m²)
- b) Low grammage grit, usually should be applied around 1 kg/m².

- POLISHING OF WET GRIT (GRANILLA) OR GLAZE.

In the case of full lappato over glazes and micro grit, the range of products are opening to:

- a) Microgrit mixed with vehicles applied by airless (Frequently called using Italian word "sbobba").
- b) Microgrit mixed with vehicles applied by vela or bell.
- c) Matt Glaze applied by vela or bell.
- d) Glossy Glaze applied by vela or bell.

3.1.2. BASIC PROBLEMS.

The most common problems on these polishing processes:

- SCRATCHES:

Marks or lines that are observed on the surface of the product, generating a defect or a lack of homogeneity in the polishing.

These marks can be originated by different causes:

- Water from the polishing process: there are usually particles in suspension that generate these defects. Review and control the filtering and water treatment process, additives and facilities.
- Tiles in bad condition (blunt, with glaze or material at the edges, broken or with sharp edges, with excessive lunette, ...)
- Mechanical problems (deformed guides or heads in bad conditions)
- Abrasives deteriorated (broken tooth, broken abrasives, remains of pieces embedded in the abrasives).

- SURFACE DEPRESSIONS:

These are areas on the surface of the piece that cannot be easily polished, because they are lower than the surrounding areas. Once the material is polished, they originate some unpolished areas with different size (smaller to larger size).

Generally, they are generated by poor planarity or deformity of the piece, so we should check:

- Pressing process (charge on the molds, proper working mold, movement of the press charge ...)
- Firing process (bad adjustment of firing curve, dirty rollers, pyroplastic deformations due to excess temperature, ...)

- SHADOWS:

We refer to that area where, despite having polished it, the brightness of the material is not identical to the rest of the surface of the tile.

They are usually more easily seen on the sides or edges of the pieces and / or in the central strip of the tile.

- WHITE ZONES:

We use this definition to refer to areas where it has been excessively polished, reaching the area of decorated and / or body of tile.

Of all the general problems that we have mentioned in the previous paragraphs, there are some (problems originated in the pressing or firing, scratches defects due to the water issue, ...) where we can provide few or practically no solutions with the incorporation of our products.

However, for the subject of shadows or white zones, it is essential to define an appropriate sequence: diamond grain, number of abrasives of each grain, abrasive design, abrasive composition, size, type of rubber, hardness of rubber, etc.

3.1.3. ADJUSTMENT OF SEQUENCE.

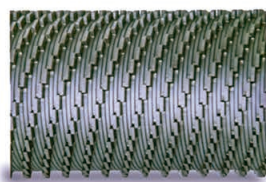
To define and adjust the correct sequence, should do a study with the conditions and type of material to be polished, and then chose the range of products to be used.

The steps should take to adjust are the following

- Type of polished finishing desired: gloss, matt or honed/semi-gloss.
- Conditions established by the customer: number of heads of the polishing machine, brand and model of polisher, size of the tiles, priority on the type of surface (more specular or more diffuse), productivity / quality, speeds
- Material to be processed: all-mass technical porcelain, dry grits (granilla), wet grits, glaze ...
A study has been made where we have checked the thickness of the layer to be polished depending on the material, so that we know the working range and the microns that we can polish in each case.

Considering the previous aspects, can be fixed:

- Usage of calibration machine or not. (They are only used for technical porcelain).



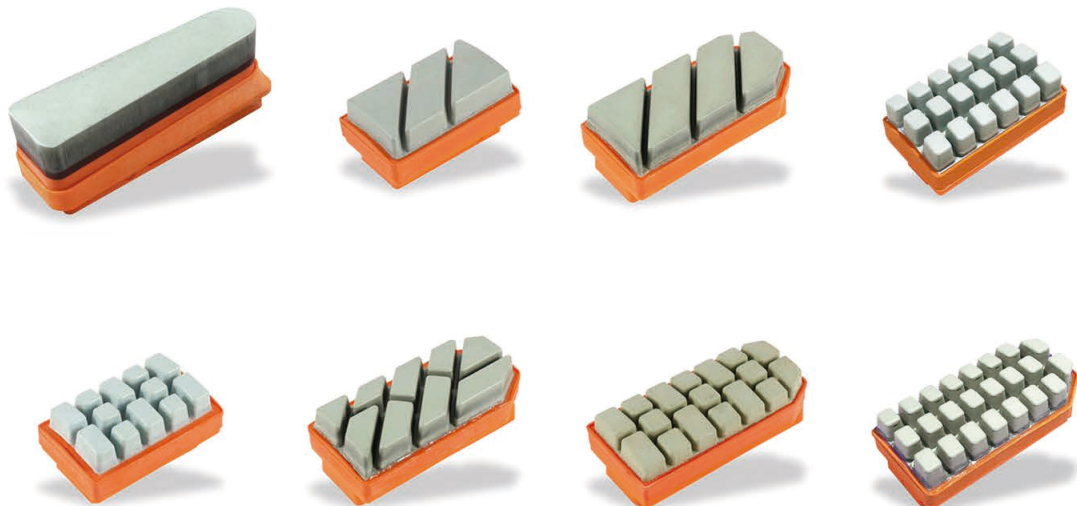
- Usage of metallic fickerts or not..



- Sequence of diamond grits..
- Number of heads per grit.
- Formula or composition of the resin diamond abrasives: with more or less cutting capacity.



- Abrasive design and size



- Type of rubber to apply (hardness and shape).



3.2. LAPPATO.

We call lappato to the process which just be working over the top of the product, generally with some irregularities to be polish the top (can be relieve from the press/mols or with some printing powder or grit application)

We can find mainly 2 types of lapatto:

- Printing powder surface: We use just resin diamond abrasives
- Micro grit surface: In there before abrasives we will sometimes use brushes (diamond or silicon carbide), reducing the initial roughness of the pieces to minimize the consumption of the abrasives, mainly in the first positions.

Generally, the finishing on this effect is glossy but we are also offer the possibility to produce it on matt finishing.

3.2.1. BASIC PROBLEMS.

Main problems that we are facing on this process are the same that we can find on the previous explained (full lappato). We are speaking about:

- **SCRATCHES**
- **SURFACES DEPRESSIONS:**

In addition to the previous ones, in this case we include as main problems the following that we detail below :

- **SURFACE HETEROGENEITY:**

The surface of the piece has to be equal lapped everywhere in all the areas, without seeing differences of shadows or lapping type.

The layer of lapping material is very thin, and it is necessary to achieve that the abrasives are fitting well to any irregularity, obtaining the desired texture.

- ABRASIVE CONSUMPTION:

As in the case of full lappato, although it has not been remarked as one of the main ones, the issue of the cost of abrasive per square meter is already important, in the case of the lapped it is transcendental. In this case, the consumption of abrasive is usually lower than that in the full lappato, so any small increase is difficult to defend in front of final customer.

Like in the full lappato, are some problems that we cannot do many things or provide any solutions with the application of our abrasives.

On that cases, we will work hard to be adjusting the proper sequence in order to obtain the best performance cost/sqm and a proper Surfaces, with correct and homogeneously lapped finishing.

3.2.2. SEQUENCE ADJUSTMENT.

To define and adjust the correct sequence, should do a study with the conditions and type of material to be lapping, and then chose the range of products to be used. For the lappato the procedure should be aprox. Like this:

- Desired finishing of lappato: gloss or matt
- Conditions established by the customer: number of heads of the polishing machine, brand and model of polisher, size of the tiles, productivity, speeds, etc.
- Class and hardness of materials to be lapping: if are grits / granillas or glazes, granulometry in case of grits, hardness regarding the glazes

Considering the previous aspects, can be fixed:

- Sequence of diamond grits.
- Number of heads per grit.
- Formula or composition of the resin diamond abrasives: with more or less cutting capacity.



- Abrasive design and size.



- Kind of rubber to apply (hardness and shape).



3.3. BRUSHING.

Is a mechanical process that by brushes changes the surface appearance of the product, obtaining a softening of the texture or roughness of the piece.

Nowadays is not so frequent but is gaining many customers and is reaching its spaces into many productions, because is a quick, cheap and much easier process than the rest of polishing.

We can divide in two types: dry brushing and wet brushing.

3.3.1. TYPES OF BRUSHING

- WET BRUSHING.

We identify this kind of brushing because come produced in the polishing machine. In this case cannot be reached a matt effect but appears a small surfaces modification. Some costumers called super soft lappato, but we consider is not a lappato cause the production speed are completely different.

We used the following tools for this work:



- DRY BRUSHING.

This process can be produced with the brushing machine.

Usually, the dry brushing is coming to reach one of these objectives:

- Obtain a softer and silky texture from a rough material.



- Homogenization of protective liquids, kinds coating or “nano products”, usually here just used the circular brushes



4. SURFACE TREATMENT.

4.1.DEFINITION.

This is the manufacturing process that is generally carried out after the polishing process. The objective for which it is carried out is to be able to close the open surface porosity in the machining process, improving then the technical performance of the product.

The process consists of applying a protective chemical liquid which, by the use of brush heads, distributing perfectly over the surface of the piece and the excess is eliminated.

4.2.4.2.TYPES OF TREATMENT.

There are mainly two ways to carry out the surface treatment:

- THERMO-MECHANICAL.
- BRUSHING.

4.2.1. THERMO-MECHANICAL TREATMENT.

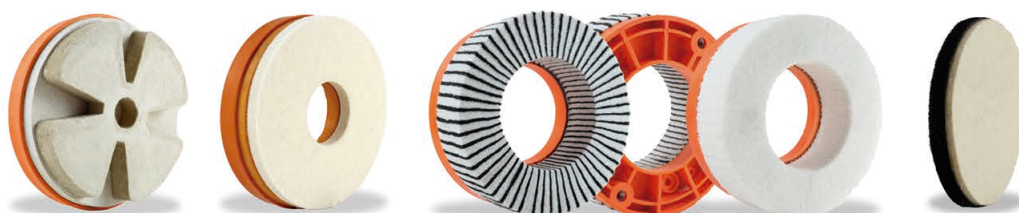
This process is carried out by a mobile bridge machine, composed of heads similar to those are assembled in a polishing machine



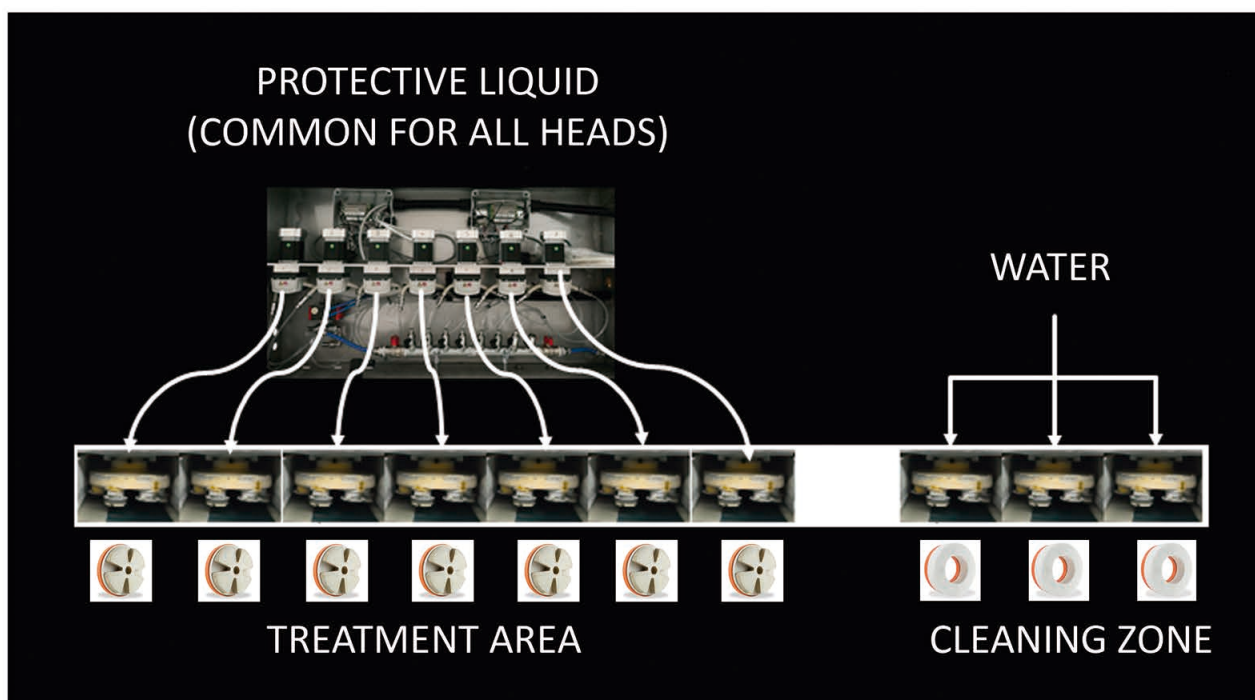
With the use of brushes placed in mentioned heads, a high pressure is exerted by rubbing the surface of the ceramic material while depositing a continuous drip (controlled by peristaltic pumps) of the protective liquid. This friction generates an increase of temperature in the surface of the pieces (even reaching 100 °C in some cases) and causes the liquid to enter in to the pores and solidify.

In most part of the cases, the first heads are used to exert pressure (between 6 and 10 heads) and those of the final part (generally the last three) to clean the pieces by usage of water, which is fed from the inside of the heads. Should be noted that the chemical liquid is common for all the heads that are used for friction and that, due to the high temperatures that are reached in the brush-piece contact area, a minimum amount of product is needed in each head to be able to work without problems (none can work without liquid).

The tools used in this process are those shown below:



As a summary, a process diagram of the operation is detailed:



Regarding this type of application, detail the following considerations:

- This is a process that requires the application of a large amount of protective liquid, more than 100- 150 gr / m².
- The chemical liquid used is a suspension of solids water based, with a very acidic Ph.
- This liquid is common for all the heads.
- Due to the large amount of liquid applied, the cost of the process is quite high compared to the treatment by "brushing" type.
- It is used mainly for very porous materials, although is also suitable for the rest.
- The pieces are completely protected as soon as they leave the application area.

Finally, regarding the problems that can be generated in the process, highlight the issue of marks or burns due to lack of liquid and / or excess of pressure. As well as the issue of line stoppages, because they cause inadequate temperature in the working area and, therefore, some pieces will not be protected correctly.

4.2.2. BRUSHING.

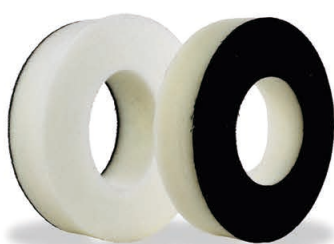
For this type of process, are used brushing machines with several heads, in which the brushes are assembled. These machines are made up of lower power motors and, therefore, cannot transmit a pressure to the piece, as in the case of the treatment explained in the previous section.

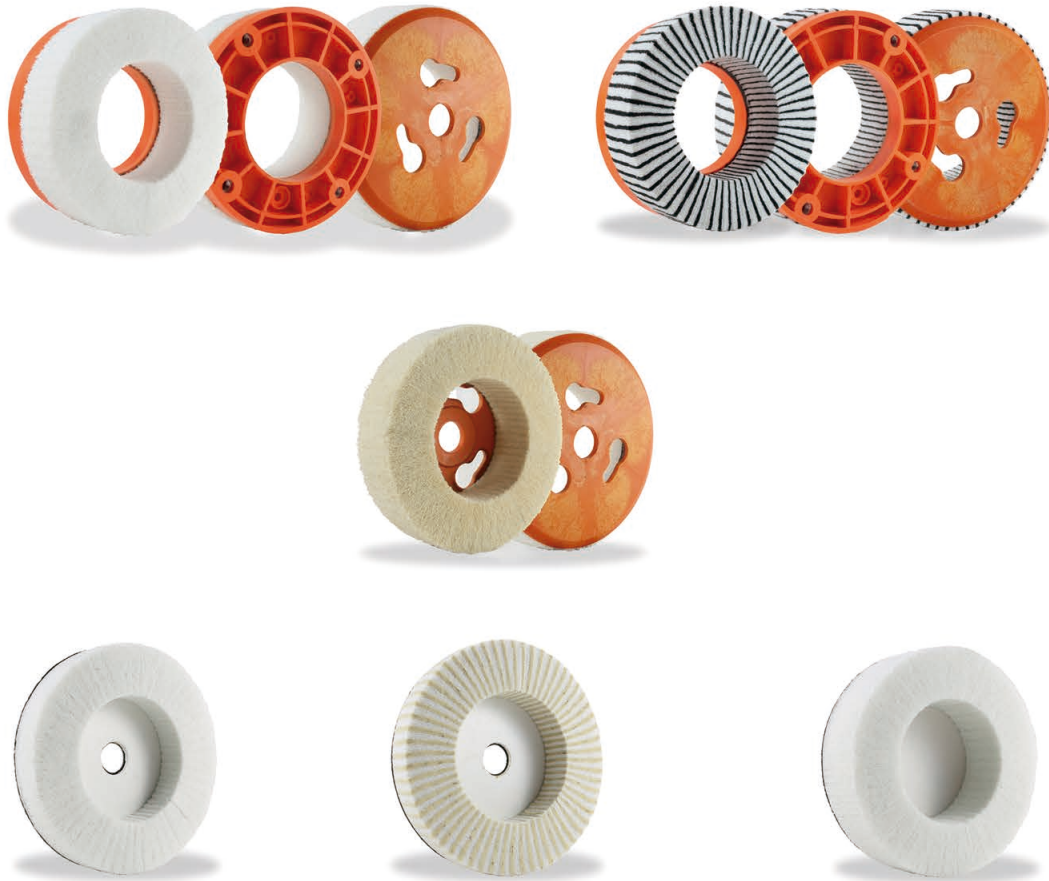


In this case is not necessary be applying liquid on every head, therefore, in most part of cases, the apporthing of liquid to the surface of the piece is done by using a roller (silicone or vulcanized rubber) in a stage prior to brushing. Is in the brushing machine where excess sealant is distributed and removed.



The tools used on the mentioned process are ones will find here below:





Regarding this application, detail the following considerations:

- It's a process where a low amount of protective liquid is needed, about 10-20 gr/m².
- Usually, the chemical liquid used is a suspension solid in aqueous based, with a practically neutral Ph. Although sometimes the formulation is solvent-based (which makes cleaning very difficult on production lines).
- If several applications are placed, different products can be used in each of them (filler, anti-fingerprint, ...)
- The cost of this process is considerably lower than the treatment mentioned in the previous point..
- Mainly used for materials with low porosity..
- If water-based waterproofing is used, the pieces are completely protected as soon as they leave the area of application. In all other cases, is appropriate to carry out the test after 24 hours..

If we consider that the formulation of these chemical liquids is not acidic, is usual to place a previous application to be able to strip the piece. For this, it is necessary to apply an acid solution using a roller (never dripped), covering the entire surface of the piece. Subsequently, this surface layer is removed with pressurized water and the piece should be dried before the area of application of protective liquid.

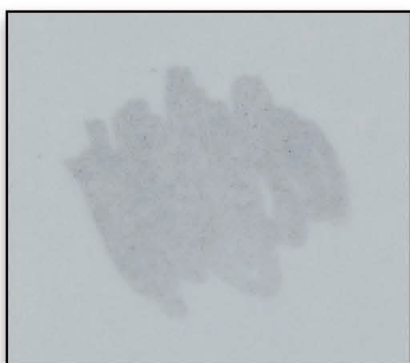
4.3. SELECTION OF APPROPRIATE TREATMENT.

In order to choose the appropriate treatment, a series of tests are carried out in our laboratory SIGMALAB.

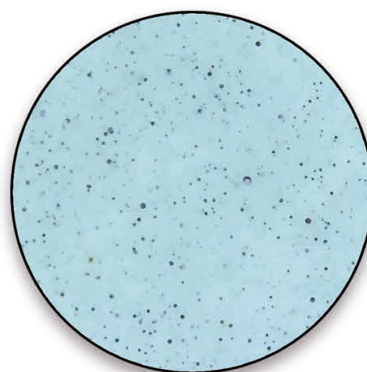
The checks carried out on the product are detailed below, both, before being treated, and after the treatment that we consider appropriate has been applied.

- STUDY OF POROSITY THROUGH MICROSCOPE.

By using a microscope, the visual porosity and microporosity of the product is checked. The method consists of staining the product with a marker, cleaning it with the corresponding agents and finally reflect the porosity and microporosity that persists in that area.



VISUAL POROSITY



MICROPOROSITY

- DETERMINATION OF STAIN RESISTANCE.

According to the ISO 10545-14 regulation, the product is exposed to a series of substances that stain for a certain time. Once the marked time has elapsed, it is cleaned considering the mode detailed in the mentioned regulations and the persistence or not of stains is checked.

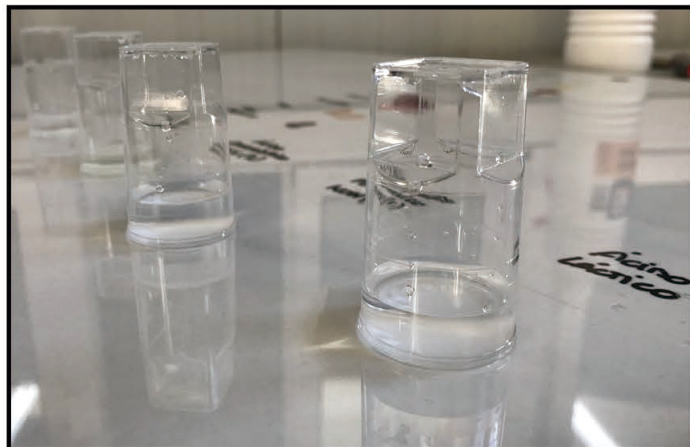


SPANISH NORM UNE-EN ISO10545-14

- STUDY OF RESISTANCE TO CHEMICAL AGENTS.

The ISO 10545-13 regulation, establishes a test method to determine the chemical resistance of ceramic surfaces at room temperature.

Taking into account the stipulations of the aforementioned regulations, the pieces are exposed to the corresponding chemical agents and the surface changes caused are checked and analysed.



UNE
Normativa Española

Spanish Norm
UNE-EN ISO 10545-13
Julio 2017

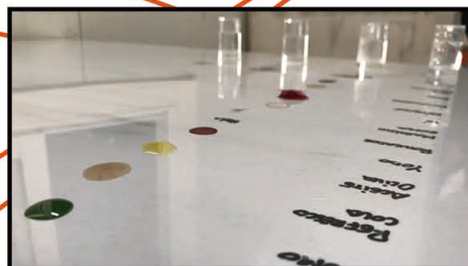
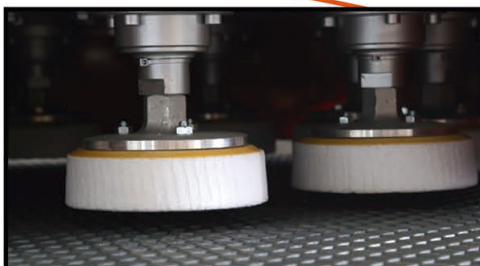
All the previous tests are carried out on the treated and untreated parts, comparing the results, and then establishing the advantages that exist in the treated product.

With this, product quality files are generated, and the results are classified.

SIGMA : APLICACIÓN TRATAMIENTO SUPERFICIAL		SIGMA DIAMANT		
PROYECTO:	79			
NÚMERO DE PÁGINA:	1 - 2			
FECHA PRUEBA:	04 - 09 - 2020			
CLIENTE:	GRUPO SD			
PROVEEDOR LÍQUIDO:	SIGMADIAMANT			
- DESCRIPCIÓN MATERIAL				
	1	2	3	
TIPO MATERIAL FLUIDO:	GRANILLA GEL	GRANILLA GEL	GRANILLA GEL	
ACABADO SUPERFICIAL:	BRILLO	BRILLO	BRILLO	
DATOS LUX INICIAL	92 - 98	92 - 97	93 - 98	
1ª APLICACIÓN				
LÍQUIDO:	CLEANKER 315H	CLEANKER 315H	CLEANKER 315H	
RODILLO TECNOLÓGIA:	MASK 400	MASK 400	MASK 400	
VELOCIDAD (m/min):	5	5	5	
AGUA (gr/m2):	SI	SI	SI	
SOPLADO:	SI	SI	SI	
DATOS LUX	89 - 93	88 - 92	88 - 93	
2ª APLICACIÓN				
REFERENCIA LÍQUIDO:	PROTELITE 120H	PROTELITE 120H	PROTELITE 120H	
TECNOLOGÍA:	MASK 400	MASK 400	MASK 400	
Velocidad (m/min):	5	5	5	
Gramaje (gr/m2):	10	10	10	
CEPILLADO:	Velocidad cinta (m/min)	7	7	7
	Vel. Rotación cabezal 1 (Hz)	150	150	150
	Vel. Rotación cabezal 2 (Hz)	150	150	150
	Vel. Rotación cabezal 3 (Hz)	150	150	150
	Vel. Rotación cabezal 4 (Hz)	150	150	150
	Presión cabezal 1 (mm)	-1,5	-1,5	-1,5
	Presión cabezal 2 (mm)	-1,5	-1,5	-1,5
	Presión cabezal 3 (mm)	-1,5	-1,5	-1,5
	Presión cabezal 4 (mm)	-1,5	-1,5	-1,5
	Flap 04489	FLAP04489	FLAP04489	
	FLAPMV30	FLAPMV30	FLAPMV30	
	FLAPMV30	FLAPMV30	FLAPMV30	
	FLAPMV30	FLAPMV30	FLAPMV30	
DATOS LUX	92 - 98	92 - 97	92 - 98	
DATOS LUX A LAS 24H				
OBSERVACIONES				
(*) PRUEBA 5 = DOS APLICACIONES DE LÍQUIDO TAPAPOROS + CEPILLADO				
El informe únicamente es para nuestro cliente y contiene información orientativa para procesos industriales obtenidos de los test específicos preliminares.				

SIGMA : RESULTADO PRESTACIONES		SIGMA DIAMANT	
PROYECTO:	79		
NÚMERO DE PÁGINA:	2 - 2		
FECHA PRUEBA:	04 - 09 - 2020		
CLIENTE:	GRUPO SD		
PROVEEDOR LÍQUIDO:	SIGMADIAMANT		
ENSAYO DE MANCHAS			
	1	2	3
ÓXIDO DE CROMO VERDE	5'	D1	A1
	1H	D1	A1
	24H	D1	A1
REFRESCO COLA	5'	*A1	*A1
	1H	*A1	*A1
	24H	*A1	*A1
ACEITE DE OLIVA	5'	A1	A1
	1H	A1	A1
	24H	A1	A1
YODO	5'	*A1	*A1
	1H	A1	A1
	24H	D1	A1
ROTULADOR	5'	D1	D1
	1H	D1	D1
	24H	D2	D1
MARTILLO DE GOMA	5'	D2	A1
	1H	D2	A1
	24H	D1	A1
TÉ	5'	A1	A1
	1H	A1	A1
	24H	A1	A1
KETCHUP	5'	A1	A1
	1H	A1	A1
	24H	A1	A1
PINTALABIOS	5'	D2	A1
	1H	D2	A1
	24H	D2	A1
VINO	5'	*A1	*A1
	1H	*A1	*A1
	24H	*A1	*A1
OTRO	5'		
	1H		
	24H		
TIPO DE AGENTE LIMPIADOR : A-AGUA; B-(AGUA + JABÓN); C-ALCOHOL; D-ACETONA; E-DISOLVENTE			
MANCHABILIDAD: 1 - NO SE OBSERVA MANCHA; 2 - UGERA MANCHA; 3 - MANCHA MUY APRECIABLE			
ENSAYO RESISTENCIA AGENTES QUÍMICOS			
	1	2	3
HCL (D)	24H		
KOH (D)	24H		
ACIDO CITRICO	24H	B DÉBIL	B DÉBIL
	72H	B FUERTE	B DÉBIL
KOH (F)	72H	C	C
	72H	A	A
ACIDO LÁCTICO	72H	A	A
NORMA ISO: CLASE A: Sin cambio superficial visible. CLASE B: Ligero cambio superficial CLASE C: Modificación parcial o total de la superficie original.			
OBSERVACIONES			
En las manchas el (*) indica que luego de su limpieza hay un cambio superficial. En los agentes químicos el B DÉBIL indica que hay un muy ligero cambio superficial pero mucho menos visible que en el caso del B FUERTE.			
El informe únicamente es para nuestro cliente y contiene información orientativa para procesos industriales obtenidos de los test específicos preliminares.			

Notes



Sigma
DIAMANT

Spain

Brazil

Russia

USA

Mexico

Poland

Portugal

Turkey

Polígono Industrial Supoi 8 - Parcela M5 B1 Nave 17
12550 ALMAZORA - Castellón - SPAIN
Tél. +34 964 562 713
info@sigmadiamant.com



www.sigmadiamant.com