Most of the softening products present analogous characteristics to a detergent: a long aliphatic chain and a hydrophilic part. Its classification is usually based on characteristics from the hydrophilic part. Thus, there are the following softeners: non-ionic, anionic, cationic, amphoteric and reactive. The last ones are those, which present best fastness to washing, since they are chemically fixed to the fibres.

The **anionic softeners** are soft, plain, full and rough to the touch and present an insulating stability. They are stable in alkaline baths and stable to almost every dye, except for cationics with which efficiency is lower than cationic and non-ionic softeners.

The **cationic softeners** are very soft, sliding and bulky to the touch and are usually used in colours, since it can modify the white degree applied in almost every fibre. They are little hydrophilic and antistatic.

The **non-ionic softeners** present an independent efficiency from the pH and they are resistant to hard water. Softeners that are part of this group are the amphoterics and softeners based on silicone (with a mediocre hydrophilic effect), and the ethoxylates that have a very good hydrophility, a good insulating stability without causing yellowing, but these ones have an effect less intense than the cationic softeners.

The **reactive softeners** are usually applied in permanent finishes – they are resistant to washing (on the contrary of others) and react to cellulose fibre. Beyond the soft effect, they have a slight hydrophobic finish.

Softeners, with **HYDROPHOBIC** characteristics, confer a pleasingly soft, bulky and sometimes fatty to the touch. Softeners, with **HYDROPHILIC** characteristics, provide generally a drier touch and very often they are designated as less soft.

Due to the ionic character of most softening products, it is better to consider the possibility of an incompatibility with others products. The more usual case is the cationic softeners that are incompatible with anionic products and cause frequently the yellowing of optical whites. It is important to refer that using softeners on the fabric is propitious to pilling and increase the risk of fabrics yellowing during ironing.

Most of the softeners reduce the fabric hydrophility, which is a great inconvenient (in the case of towels that doesn't clean). In another hand, the fastness in washing is always more and less limited. However, housewives can proceed to the softening introducing those products in the last rinsing water.

While it is possible to apply all softeners by PADDING, by EXHAUSTION it is only possible for those that present substantivity.
In general, cationic and amphoteric products can be applied by exhaustion on all fibres.
The exhaustion rate varies in function of the products and the fibres.
When you want to use cationic products with the dye fixation, this one can prevents the softener action (blocking effect). Thus, it is preferable to soften the fabric first and then apply the fixation agent – best touch effects.

Thermoplastic Resins

These resins are polymers obtained generally by polyaddition and, as the name indicates, they soften when heated. They are deposited on the textile fibres and show a certain fastness in the washing but no to organic solvents. They can be soluble or insoluble into the water.

Insoluble thermoplastic resins are most used in textile finishes. They are applied in the form of aqueous dispersion that contain, beyond the polymer, emulsifying and plasticising agents. The main applications are the stiffening finishes (increase of the fabrics body and weight) to reduce the yellowing obtained through light exposure, to increase threads and fabrics strength, to coating, etc., but without great demands on the washing fastness and dry clean.

The main thermoplastic resins are based on: polyvinyl chloride, polyvinyl acetate, acrylic polystyrenes, polystyrene, polyethylene, polyamide, etc.

Soluble thermoplastic resins are most used as sizing products, printing thickeners or sometimes as stiffening finishes. They are simultaneously applied with a thermosetting resin and they take to a reduction of the resistance to tensile and to normal abrasion in cross-linking finishes. Into this group, we can refer polyvinyl alcohol and polyacrylic acid.

Thermosetting Resins

General principles

Nowadays, thermosetting resins are almost compulsory part of the finishing bath of fabrics that contain cotton or viscose. As the name indicates, they are substances, when heated, polymerise and beyond that they can react with cellulose.

In a generic way, we can talk about "cross-linking finish", including the following effects:

- **Wrinkle-resistant or smooth finishing (no-iron, easy-care, wash-and-wear);**
- **"Teflon", "Scotchgard" finishing;**
- **Permanent-press finishing;**
- **Shrink-resistant finishing.**

The wanted looks – dimensional stability and wrinkle recovery – are obtained thanks to the formation of a three-dimensional polymer inside of the fibre (mostly inside of the amorphous areas) but also due to the reaction to cellulose, forming bridges or cross-links.

Besides the improvement effects of the wrinkle recovery angle (screening when dry and wet) and the dimensional stability, this kind of finishing presents the following second effects:

- **Reduction of the tensile resistance;**
- **Reduction of the abrasion resistance;**
- **Great sensitivity of the fabric to chlorine treatment;**
- **Eventual modification of the colour tonality;**
- **Reduction of dyes and actives fastness, mostly in the case of direct and reactive dyes, except for fastness in wet treatments (water, washing, perspiration, etc.) that is commonly improved;**
- **Eventual yellowing of fabrics;**
- **Modification of the touch;**
- **Formaldehyde release.**

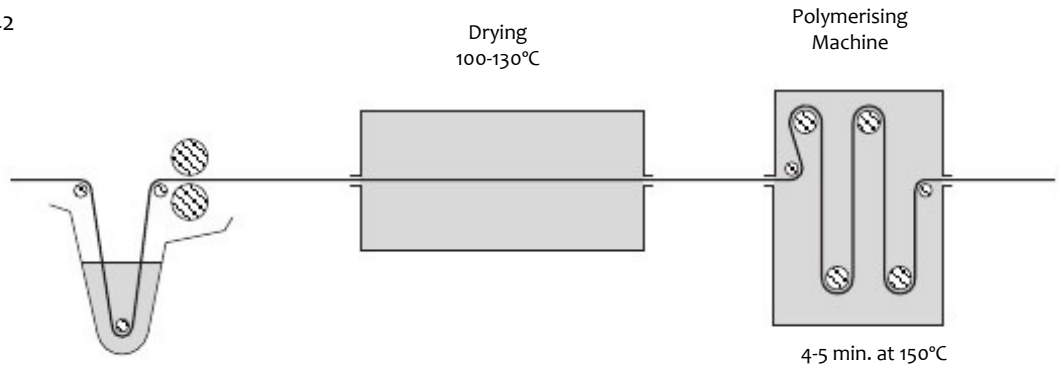
At present, most of the commercialised thermosetting resins are based on urea and formaldehyde (and include in this group the so-called derivatives of cyclic urea) or condensates of melanin and formaldehyde, denominated of self-condensable, once they can be applied to any fibre, with the disadvantage of the formaldehyde release in large quantity.
The reactive resins respond directly to the cellulose fibres, originating a lower formaldehyde release.
There are still resins without formaldehyde, denominated glyoxylic, used in finishing for baby articles, which results are not as good as in the wrinkle-resistant finishing.

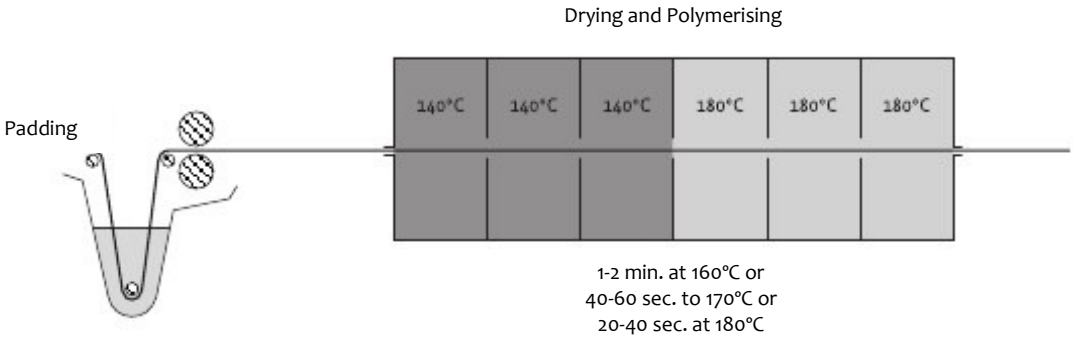
To apply these resins, it is fundamental that the fabric had endured the appropriate treatment, namely a good desizing, boiling (good and uniform hydrophility) and, if possible, a mercerising.
Reactions of polymerisation and cellulose cross-linking are only performed in a noticeable way with a catalyst. Catalysts can include since very strong acids (type Lewis acid, etc.) to strong acids as the hydrochloric acid. The catalyst choice depends on the level of the fibre swelling during the cross-linking process.

Fixation processes

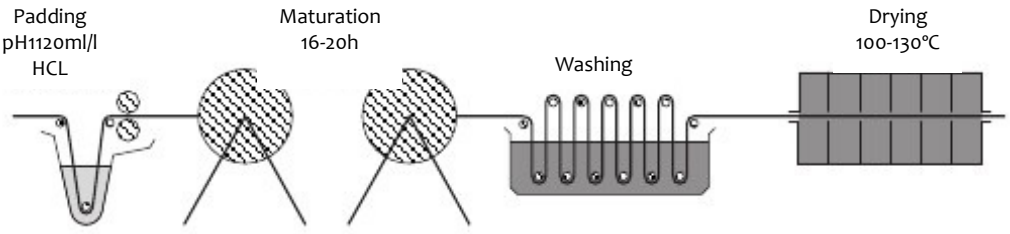
The most current finishing process is the dry cross-linking where is made a drying after the impregnation followed by a thermal treatment at high temperature (120°C to 200°C) – condensation stage. For this process, weaker catalysts are used and will remain on the fabric, once it is not usual neither economic to proceed to the washing after the finishing. With this process, we can reach to an improvement of the wrinkle recovery, mostly when dry, but the losses of tensile and abrasion resistance can be noticeable.

Drying and condensation can be performed in a single machine. Therefore, we are talking about the "flash" process (or shock process), commonly applied to stentering but obliges to a lower speed.

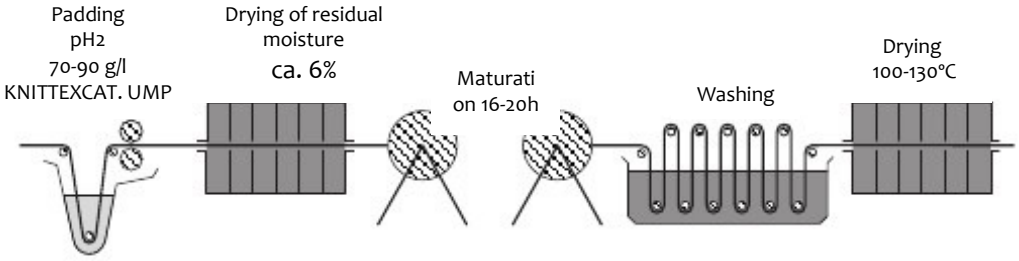




The wet cross-linking is realized through the partial dry of the fabric, letting it soak, wound, for several hours. Catalysts to be used must be stronger, which obliges generally a washing. The improvement of the wrinkle recovery angle when wet (behaviour "wash-and-wear") is better than in the dry cross-linking, and the tensile and abrasion resistance losses are lower.



Damp cross-linking is performed through the fabric winding after the impregnation followed by a soaking for several hours. For these processes, catalysts type strong acid are needed, which obliges to have a washing before proceeding to drying. The losses of tensile and abrasion resistance are minimal and it occurs an improvement of the wrinkle recovery angle when damp but not when dry.



Here, there are shown some simple tests that should be performed for quality control in the production and that can prevent from irregularities in the finishing:

- **Checking of the resin fixation degree:** with an indicator blending of dyes, it is possible to verify which the degree of the resin fixation is;

- **Checking of the temperature uniformity in the condensation chamber:** to have the uniformity of the resin fixation in the whole fabric width, the aerodynamic performance of the condensation chamber (hot-flue or stentering) must be perfect, in order to avoid temperature variations;

- **PH control of the fabric:** as for the resin condensation, it is necessary an acid medium. The fabric shouldn't previously have an alkaline pH that would neutralise the catalyst effect.

With the P**ermanent-press** finishing, the purpose is that the made-up article has a "shape memorising", in others words, avoiding seaming deformation during the washing and the wanted creases are permanent. For that, we can proceed by three ways:

Pre-curing process: resins condensation is done, totally or partially, in the finishing stage, and the manufacturer only have to press the articles; it is the most usual process in Europe;

Post-curing process: a resin/catalyst system is applied on the fabric and only actuate at high temperature. In the finishing stage, the fabric is only dried and the resin is condensed after production, introducing it into a high temperature chamber.

Process of finishing application only in the manufacture: the manufactured articles are introduced into a high temperature chamber, where vapours from cross-linking products will be blown.

Hydrophobic Products and Lipophobic Products

For certain purposes, the fabrics have to be waterproof but have to let the air passing through them. For that, we must modify its surface tension in relation to the water that is achievable thanks to hydrophobic products.

There are several products with those properties, since waxes to reactive products, but today the most important ones are silicones that present a reasonable fastness to washing and dry cleaning.

It is important to enhance that softening products reduce generally the fabric hydrophibility.

The waxes/paraffins form what we call a "barrier" perpendicular to the fibre surface and prevent from water passing across.
Polysiloxanes form a silicone film involving the fibres also perpendicular to the fibres surface, which confers hydrophobic properties.
Fluorocarbon polymers form also films perpendicular to the thread axis, preventing from the wetting of the surface – but with hydrophobic and lipophobic action (explained by the extremely low surface tension of the fluorocarbon chain relative to chemical compounds).

The hydro-lipophobic effect of the fluorocarbons is excellent on synthetic fibres, in spite of having an insufficient water repellent action in the cellulose fibres – that's why the application is performed with others products based on melamine and paraffin resins.

Jeans treated with permanent Teflon finishing – water and oil repellent article (doesn't damp neither soil with sludge, rain, snow, dew, etc) and have an identical appearance/touch to traditional jeans.

Anti-foaming Products

The foam formation is usually unwanted in the dyeing as much as in the printing. Thus, it can be necessary to introduce in the finishing bath products that reduce the formation of foam. The most current are fatty alcohols and silicones.

Meanwhile, we have to point out the new finishing techniques where it is precisely pretended a high quantity of foam.

Fireproofing Products

In the last 20 years, great efforts have been developed in order to protect the people from fire dangers caused by textile articles. The research in the industry of finishing products leads to the commercialisation of products range with fireproofing properties, mostly for the application on cellulose fibres. The industrialised countries begin to impose more and more restrictions concerning flammability of certain types of articles (baby clothing, tablecloths, carpets in public places, etc).

- Among those products, we can refer the following:
- **Mineral salts that don't present any fastness during washing;**
- **Halogenated derivatives; (chlorinated polymers, titanium and antimony chloride, etc.)**
- **Phosphor and halogen derivatives;**
- **Derivatives based on nitrogen and phosphor (among which we can include products THPC and APO type, usual in the United-States, and Pyrovatex CP®, usual in Europe).**

The application of most these products should be done simultaneously with a thermosetting resin. To obtain an important fireproof effect, we have to apply approximately 20% of the product in relation to the fibre weight, what might naturally affect the fabric touch.

Biocidal Products

The natural/artificial fibres, namely cotton and viscose, can be attacked by mircoorganisms of bacteria and fungus type that originate mould. This attack is exposed by an unpleasant smell, by the formation of coloured soils and by the loss of the articles' mechanical strength. The attack is helped by the high moisture conditions and the mild atmosphere, and is hindered by the sunlight. Those conditions can happen during the fabrics' storage.

Like wool and its blending can be attacked by moth and other type of insects.

There are several organic products that can be applied to textile articles to prevent this attack and it is essential not to be toxic when in contact with the human body:

- **For a permanent protection, products can be applied simultaneously with the dyeing to impede fibres of being assimilated by moth larvae, which is the case of commercial brands Mitin and Eulan that present a reasonable fastness to washing.**

In this group are included mites proofing and mothproofing finishing.

Microorganisms can also attack synthetic fibres. Not the fibre itself but they attack the sizing agents and finishes.

Biocidal products can have the following functions:

- **Fungicides –** fungus removal
- **Bactericides –** bacteria removal
- **Fungistatics –** prevent from fungus formation
- **Bacteriostatics –** prevent from bacteria growth

The care and disinfecting agents are usually based on:

- **Phenolic Derivatives**
- **Organic and Mineral Metal Salts**
- **Formaldehyde Derivatives**
- **Quaternary Ammonium Derivatives**

They can be applied by exhaustion, padding and pulverizing.

Recently, this type of finishing introduced the notion of Textile and Bioactive Finishing, in others words, they have the property in protecting the user against microorganisms, restraining its proliferation, eradicating them totally. This type of finishing reveals an innovator appearance because they are used in clothing (socks and others articles with direct contact to the skin), textiles for hospital purposes, and technical articles.

Antistatic products

Synthetic fibres load easily static electricity, due to its weak electrical conductivity related to the weak moisture absorption.

To reduce this effect, enzymatic products are applied in the fibres manufacturing, which ones are however removed in the pre-treatment operations. Then, it is convenient to include antistatic products into the finishing bath, which ones according to their characteristics can have larger or lower fastness in washing.

Plasma

This treatment submits the textile article to an electromagnetic field, in a gas partially ionized under certain pressure.
The plasma is defined like ionized gases – ions, electrons, photon, radicals and neutral particles with no electrical charge, produced by electrical discharges.

This ecological treatment incorporates in the article the following characteristics:

- **Increase of the absorption capacity.**
- **Increase of dyes affinity, fastness, lustre and touch.**
- **Reduction of the shrinkage and anti-felting effect of the wool.**
- **Improvement in the soil-repellent treatment.**

Cationization

It consists in the ionic modification of the cellulose chemical structure (cotton and viscose) with a cationic product, to modify its dyeing characteristics.
In this way, the aim is to achieve fastener dyeing processes with a minor quantity of dyes and textile auxiliaries.

Application examples:

- **Differential dyeing:** "tone-on-tone", reserve or contrast effect and tricolour effects (substrate: treated thread/PES/CO no treated)

- **"Vagabond" finishing** with Sandozol dyes

Functional Textiles

Functional textiles, knits or woven fabrics, present characteristics of touch, comfort, hygiene, flexibility and easy care.
They are the textiles that, incorporating some type of raw materials or finishing, provide certain functions:

- **Perfumed clothing**
- **Thermoregulated sweaters**
- **Filling of antibacterial pillows**
- **Shirts of 100% cotton that don't crease**

- **Antibacterial Underwear**
- **Socks with no smell**
- **Impermeable, transpirable and stretchable sports clothing**
- **Anti-UV T-shirts (blending of cotton and polyester, containing in the polyester core ceramic fibres that reflect the UV rays and retain the infrared rays)**
- **Bio-actives for the furniture**

Those articles, denominated Functional, will obtain the indicated properties. They require a highly technological development that confer them added value, allowing to be differentiated from the concurrence and win segments of the market.
Many treatment methods provide these properties.

The finishing can be performed by the introduction of an active agent in the fibre core, applied to the liquid polymer, before the extrusion stage – ex.: antibacterial fibres and mites proofing.
In others cases, the additive is previously applied on the fibres or on the article, by means of a binder.

The **micro-encapsulation** isolates the active principle and allows a controlled release, considering the thickness and porosity of the microspheres membrane (ex.: perfumed articles, the perfume comes from microcapsules that open during product life).

It is possible to get thermo-regulated articles (protection according to the temperature) through the microcapsules integration into the articles, containing a material that changes the stage – PCM (substance that melts storing energy, restoring it during the posterior crystallization, with the temperature reduction).

Washing

Objectives:

- **To introduce discolouration and touch effects.**

Washing types:

- Enzymatic (enzymes)
- Stone-wash (stones)
- Chemical (sodium hypochlorite, etc.)

Stone-wash (stones)



Softening

It is designated to improve the touch, the suitability of the seam and the article appearance.
It can reduce the hydrophility, increase the pilling and originate the yellowing.

Objectives:

- **Fungicides** - fungus removal
- **Bactericides** - bacteria removal
- **Slimicides** - fungicides and bactericides
- **Fungistatics** - prevent from fungus formation
- **Bacteriostatics** - prevent from bacteria growth

Antibacterial Finishing - Attack to the fibres

Microorganisms of bacteria and fungus type attack the fibres and appear by the following ways:

- **Release of unpleasant smell**
- **Formation of coloured soiling**
- **Loss of mechanical strength**

Fibres that may be attacked:

- **Natural fibres**
  - Cotton
  - Viscose
  - Wool
- **Synthetic fibres**
  - Elastane
  - Starch

Attack conditions:

- **Temperature**
- **Moisture**
- **PH**

Sulphur Ecoldye Process

High efficiency for the dyeing process

It is a quick method of cationized sulphur dyeing on manufactured PFD garments (prepared for dyeing) and jeans. It is possible to create many different effects after dyeing, such as: corrosion paste, frayed, marbled, pigment and resin whiskers, etc.

Highlights:

- **Process at low temperature (15 min. at 60°C in the dyeing stage);**
- **The oxidation process and the washing of the sulphurous dyes are executed in a single bath (10 minutes at 50°C), with lower water consumption and operational time;**
- **Good characteristics of fastness to friction, light and washing.**
- **Minor contamination and small volume of residual water;**
- **Low soiling level in the equipments;**
- **Easier removal of the reducing agent;**
- **Lower process time;**
- **Lower consumption of water x power;**
- **Variety of the fashion effects;**
- **Reduced reproducibility and process time.**

Advanced Colour Process

Development in Technology, Quality and Productivity

It is a fast and economical process at low temperature of 60°C and it characterizes by the use of a specific cationic product (interactive) for the cellulose fibre pre-treatment before the dyeing.

The dyeing stage is carried out with high-tech reactive dyes selected for this process at 60°C, according to procedures in our colours catalogue.

This process confers to the improved clothes:

- **Excellent abrasion effect and velvet touch after the final stonewashing;**
- **Good fastness to light and washing;**
- **Great levelling;**
- **Best exhaustion and washability;**
- **Final wash with less waste dump at the effluent treatment station;**
- **Operational low-cost;**
- **Reduced process time.**

Ecoldye Process

High efficiency for the dyeing process

Ecoldye are fully ecological dyes, with a rapid process that reduces considerably the dyeing duration, increasing the productivity and with a full guaranty in the colours reproduction, on jeans and PFD garments (prepared for dyeing), in a cationic process or without cationization.

Ecoldye enhances mainly for:

- **Process versatility;**
- **Fast exhaustion in 20 min. at 60°C;**
- **Excellent levelling and washability;**
- **High index fixation and fastness;**
- **Low salt consumption in the dyeing process;**
- **Lower consumption of water and power;**
- **Lower contamination and low residual water volume.**

Biomofo Process

High efficiency for the dyeing process

Specific process to overdye by exhaustion manufactured garments, creating a "musty-like" look in low relief points on jeans, such as: waistband, belt loops, side seams, external part of the fly, pockets and stripes.

It is indicated for guiding mixtures, varying the dosage and the colour in accordance with the wished pattern and choice.

As advantages, the process has the following:

- **Presents good fastness properties;**
- **It is practical working with only one dye, excluding the possibility of errors in the production weighing.**

Ecolzol Process (Dirty Effect)

Simultaneous dyeing and softening

Ecolzol are unique dyes, dismissing textile auxiliaries from the dyeing process, indicated to fast process for the exhaustion overdyeing of jeans and PFD (prepared for dyeing) manufactured clothes.
It is indicated for guiding mixtures, varying the dosage and the colour in accordance with the wished pattern and choice.

Ecolzol enhances mainly for:

- **Reduction of the dyeing and softening operation time in a single bath**
  (20 minutes at 40°C, except for greyish tones that might be done at 60°C);
- It can also be used together with fixation agents;
- It is practical working with only one dye, excluding the possibility of errors in the production weighing and, in this way, allowing reproducibility of batches in process.

Blue Jeans Process

It enhances by the versatility of the chemical or mechanical visual effects that are characterized through ultramodern processes, in spite of being simple, which concretize by the quality and the efficiency of their applied products.

Peculiarities

In the Blue Jeans process, we work to keep the natural blue of clothes adding particular effects, such as:

- **Traditional process**

- **Brightening process with no chlorine**
  Clarol and Active; Picture 1
  Clarol and Active; Picture 2
  Redutec Plus; Picture 3

- **Bleaching process with Alvax 5060 and Hydrogen Peroxide.** Picture 4
  (it confers to the garment a natural blue, salt and pepper look);

- **Bleaching process with Bioblue and Hydrogen Peroxide.** Picture 5
  (it confers to the garment a fluorescent bluish);

- **Bleaching process with Clarol and Active Gris**
  (it confers to the garment a greyish blue look);

- **Local painting with niggled and sprayed Spray Color.** Picture 6

- **Local painting with niggled and sprayed Soft Megaprint.** Picture 7

- **Corrosion Effects with niggled and sprayed Corrofix.** Picture 8

- **Corrosion Effects with niggled and sprayed Corrodenim.** Picture 9

- **Resin effects with Hi-Soft Resin and Hi-Tech Resin.** Picture 10

- **Quick Dark Effect.** Picture 11
  (it confers to the garment a yellow look in the jeans weft and where is worn).

Picture 1

Picture 2

Picture 3

Picture 4

Picture 5

Picture 6

Picture 7

Picture 8

Picture 9

Picture 10

Picture 11

Effects

These effects are controlled chemical and physical reactions that allow a larger control in the reproductions. Most effects have ramifications:

Main effects

Corrosion Paste

Used

Polished

Stone Power with Corrodeim

Sprayed

Frayed

Niggled Megaprint

Corrodeni

Stone Power

Sprayed Megaprint