



**Autrans – Vercors Nature Reserve
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QUESTIONS / ANSWERS

To understand waxing is first of all to understand support (base).

Today in order to upgrade the performance of ski base and to strengthen its mechanical and intrinsic properties, manufacturers use the agglomeration technique.

What are the components of a agglomerated base today?

Manufacturers mix HDPE (high-density polyethylene) with such additives as polytetrafluoroethylene (PTFE), graphite, boron, gallium-indium to improve physicochemical characteristics of your ski base in extreme conditions.

This allows manufacturers to work on:

- antistatic properties;
- improvement of the hardness modulus;
- resistance to abrasivity;
- reduction of the friction modulus;
- resistance to chemical products of maintenance;
- protection of the base from oxidization;
- improvement of cohesion with hydrocarbon waxes.

This agglomeration technique obviously improves the base elasticity modulus and its resistance to thermal shocks.

How the base is manufactured?

Agglomeration consists in warming up this complex compound of uniformly blended powders without bringing them to fusion. While heating up, the grains knit together, which makes the item homogeneous. Then the mass is put into a mould and squeezed under high pressure until chipboard of highly resistant molecules is obtained. Approaching the fusion point of the compound or removing from it allows to adjust the base physical characteristics (solidity, friction and shear resistance...).

That's why ski manufacturers choose and use different types of bases for different

types of snow, for example: extra hard bases for cold snow.

Does wax penetrate into the ski base?

No, wax is never blended with polyethylene. Wax is only captured into micro cavities on the base surface. The captured quantity depends, thus, on the depth of your structure and on the absorption factor of your base. Base shouldn't be nourished, it should be protected!

What is the aim of waxing?

Waxing has two functions: protecting the base surface from oxidation (see doc. ["Oxidation"](#)) and helping to export water created through the base friction with snow.

What are the components of cleaners?

Generally they are mono-components from the aliphatic solvent family. Manufacturers use trichloroethylene or other derivatives of more complex combinations with possibly added colourings or olfactory markers. Their evaporation time is relatively long, up to some dozens of minutes. At the request of professional ski servicemen, manufacturers have improved formulas in order to speed up the solvents' evaporation while preserving wax dissolving characteristics. Numerous researches were undertaken, in particular, on ether application, forbidden because of its noxiousness.

Introduction of hydrocarbon acetates as well as wax non-solvents has allowed reducing the time of solvent evaporation, which is the main cause of base surface drying.

What is the purpose of scraping?

Depending on your needs, you can use two different methods of scraping.

Trim scraping:

Used as a rule for skis preparation before going out.

Scraping is used only to trim brushing.

We highly recommend you hot-scraping: scraping before wax starts gripping, that is before it becomes matt and white (gelatinization and then consolidation).

Hot-scraping doesn't change the wax molecule (see doc. ["Wax molecules"](#)).

Cold-scraping detects only drawbacks:

Solidified wax is hard to scrape and demands more strength. But even slightly pressing in the centre of your scrape, you squeeze a few microns out of your base, creating, thus, concave or convex zones during repetitive scraping.



Base clean scraping:

Used as a rule after skiing or after a radical change of wax.

Apply a little more wax than usually. Scrape while wax is still hot, during the phase of wax gelatinization (you should wait a bit longer than for the first scraping technique). During scraping a roll is formed in front of your plexiglass scrape. This roll of fusing wax will dissolve and lift old waxes, remnants and impurities left in the structure depth and in base micro irregularities.

What wax should be used for maintenance or trimming of your skis?

Use waxes for cold temperatures: between -15°C and -5°C (PFX1-CH or PFX6-Low). Waxes for cold snow are more fluid and, thus, penetrate more easily in the depth of the structure. They have a higher fusion temperature, which allows them to dissolve easily old waxes. This type of waxes has no negative effect in warm conditions, while warm waxes, for temperatures between 0°C and $+10^{\circ}\text{C}$, on cold snow will surely scotch you. Cold waxes solidify slowly, which allows you to clean your skis more thoroughly.

Racers should choose a maintenance wax for the whole season, as it will give them a reference. When applying racing waxes for different snow conditions, you can preview the result of a wax mixture (see doc. ["Wax mixture"](#)).

What measures to take if the base is white?

The appearance of white spots is often preceded by matt optic effect seen when observing the base under clarification after polishing.

It is needless to say that it is too late already (see doc. ["Oxidation"](#)).

There is still a way out but you should act rapidly. You've got to go to a service provider who has a file and a grinding machine to smooth and structure your skis. A grinding machine is more efficient, as it smoothes out concave or convex bases formed after metal scraping.

We advise you to find professionals who master the technique and the use of grinding machines. The sooner you do it, the better. The aim of these operations is to find in the underlayer a base zone "hydrated" uniformly. Bases are usually 0.8-1 mm thick. The operation removes a 12 to 50 μm layer, depending on the structure that you want to process (cold snow or transformed snow).

What is the purpose of structure?

Structure or micro grooves is a surface topology which produces physicochemical phenomena during ski friction with snow. Its main purpose is to form and handle the water film emerging from the melting of snow crystals.

Optimal glide depends on the following two factors:

- surface roughness that produces and handles the water film;
- wax that optimizes this phenomena.

What wax features have to be taken into consideration when choosing a wax for a concrete type of snow?

- wax hardness
- wax texture (more or less greasy)

Remember that soft waxes used for cold snow conditions will “scotch” you. So you’d better always choose a hard not greasy wax if you have doubts regarding snow conditions.

Soft and greasy wax for warm conditions

Hard and not greasy wax for cold conditions

Medium hard and medium greasy wax for fresh snow

What outer signs can help to choose a right wax?

It’s important to analyse other parameters that influence the choice of wax and structure, such as:

- **Climate:** air humidity rate, air and snow temperature;
- **Track aspects:** exposure to the sun, altitude;
- **Geology of the area:** nearby lakes or underwater springs;
- **Type of snow:** shape of snow crystals transformed under temperature variations or track packing, snow humidity rate.

Should I by all means apply several waxes for one race?

Always remember that there is no such thing as superposition of layers and that numerous hot-applications of products and layers always lead to a new product. As it is said in chemistry, nothing is created, nothing is lost, everything is just transformed!

Note that highly fluorinated wax makes no harm to your skis performance on cold and dry snow with less than 40% humidity rate. It is inefficient and its use can’t be justified by slight improvements.

Are liquid waxes efficient?

There are 2 generations of liquid waxes: with solvents and with olefins.

The first have invaded the market. To 80% composed of solvents, they dissolve and keep waxes in a liquid state. After their application the solvent evaporates and the wax hardens in a couple of minutes.

These liquid waxes, just like cleaners, start to attack the base integrity and whiten it rather rapidly.

Liquid Cera Max belongs to the second generation and contains no solvent, while preserving better characteristics than hard Cera Max.

A flame mark on the wax label means that this wax contains solvents.

What is the aim of the Thermo Bag and is it efficient?

It’s only a mobile version of a steam room.

Here are the results of our study:

Process: Enclosed in an “oven” skis during the time of heating which takes from 6 to 12 hours will reach the temperature of 50°C to 65°C. The aim is to dilate the pores on your base surface and thus capture more wax.

We have determined that warm waxes (for 0°C/+10°C) with fusion point close to 54°C prove more profound penetration of wax into the structure after iron-application and during heating. But no efficiency was observed for all other waxes with fusion point above 74°C (that is for waxes in the range from -2° to -25°C).

So, to sum it up, the use of these “ovens” allows to dilate pores before applying a wax in order to increase the amount of captured wax before scraping and brushing. The efficiency was proved only for warm waxes. We advise you against using warm waxes to “saturate” the base before using your skis for the first time. For the above-mentioned reasons, we advise you to use from the beginning cold waxes for maintenance.

Leaving your skis in a right position (base upwards) near a regular source of heat will allow you to reach the same result as with a Thermo Bag. As for us, we use a heating rug of the “heat tyre type used in motor races” which provides a more efficient and less restrictive use in usual race installations. Be careful with heat guns, as their use at a short distance and at a very high temperature will lead to an opposite effect, the so called flaming technique. It makes a body porous, but at the same time rough. This technique is used in printing to stick ink to very smooth supports. Keep the distance of 30 cm and while heating brush the base with your hands so that to control the distribution.

Danger of Thermo Bags: it’s important to know that in spite of all efforts produced by ski manufacturers, today none of them works in laboratories with thoroughly controlled atmosphere. We have noticed that carrying out heating at temperatures above 65°C leads to wooden ski core deformations. Even nowadays wood (usually poplar because of its mechanical properties) hardly endures this type of treatment.

How to adjust an iron?

Wrong are those who think that a digital iron is the only solution of good wax application. Here is a simple but effective method that takes into consideration room temperatures.

The aim is to melt waxes some degrees higher than their fusion point. For this, it’s enough to put on your hot iron base a chip of wax of about 3mm size and make it melt in less than 2 seconds without producing smoke. Always start with thermostat set on synthetic and only then raise the temperature. Pay attention to iron stoking inertia and preview a slow temperature rise.

Is brushing efficient?

Brush, brush, brush...

To understand the importance and the technique of brushing, we give you different cavity sizes for polishing and specifications of the material to be used (see doc. [“New skis waxing”](#)).

Here is in microns the average size of ski structures:

For cold snow, breadth/height: 15 µm/15µm

For transformed snow, breadth/height: 80µm/100µm

Here is in microns the size of nylon, slip and bronze/brass bristles used for almost all brushes on the market:

For hard nylon brushes/ destined for trimming: 250µm

For medium nylon brushes/ destined for brushing: 180µm

For natural silk brushes/ destined for polishing: 120µm

For brass brushes: from 15 to 50µm

We hope something calls out on you!

No! Bristles can never penetrate into the structure and remove the wax.

Here are our recommendations:

As micro grooves vary in levels, thickness and depth, you should always be dynamic when brushing your skis. Move forwards swinging from right to left. Return backwards, then move again forwards and make several passes this way from tip to tail.

Work result is 20 times higher mechanically than manually. So we advise you rotary brushes:

- with a speed of 300 turns/minute to trim with a medium nylon brush;
- with a speed of 400 turns/minute to polish with a soft nylon brush.

Attention: there is a great difference in hardness between nylon for manual and nylon for rotary brushes. As a rule, 6mm in height and 300 bristles/bun suit perfectly. The final stage of polishing is always done manually. You can finish brushing as soon as you feel the brush slipping, like near the ski tail.

We advise you to clean regularly your brushes. For high level races we do it at the end of every test-day. Rotary brushing tends to create heating and soft wax wraps round bristles of your brushes. The simplest method to clean them is to wash them under warm water with some grease-removing product, like for washing-up. Dry them under a radiator. Be careful not to put them on the radiator, as you risk deforming wood sleeves. You can as well rub them in snow or one on another.

When should a bronze/brass brush be used?

Before answering, we would like to show you the results of a study on the life of structures.

We put a structure with a grinding machine and then took a positive stamp of our structure topology with silicone of very low viscosity. The stamp was then digitalized with laser scanning so that to compare the results up to every micron. We have carried out the same procedures after one alpine downhill on hard snow and compared the results. Surprise or not, but the structure topology was already "mutated", it was widened and deepened by a couple of microns. Polyethylene base hardness shore or modulus remains insufficient for generally aggressive use of skis. We have carried out the same procedures after mechanical brass brushing.

Here are our conclusions:

Avoid using brass brushes excessively; their recognized efficiency has made them a common practice with lazy bones!

The bristles of metallic brushes are more rigid despite their small diameter. They penetrate more easily into the depth of micro grooves.

Hot-scraping can also be effective without bringing damage, you've just got to be patient and willing to experiment.

But if you were to choose a brush, take a hard white nylon brush, it prevents having twisted and thus more aggressive bristles from the start.

What wax to chose for maintenance?

For experienced and professional skiers we advise to use a low fluorinated wax (type PFW6-LF). Our study on layers superposition and efficient base brushing show that

even when using mechanical means (roto-brushes) there is always a significant amount of wax left in the structure depth due to the structure geometry and the smallness of its dimensions against the size of nylon bristles (triangular form with a 50-micron base and a 3-micron top).

Wax application comes down to its penetration into that maintenance wax underlayer. Thus, if you maintain your skis with waxes without fluorine, racing wax water-repellent characteristics will deteriorate.

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