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Hot glide wax treatment and the
hardness of the ski running surface



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The aphorism illustrates status quo in the ski waxing (especially XC)

“Nothing is so firmly believed as what we least know”

Book I, Chap. XXXI. Of Divine Ordinances.

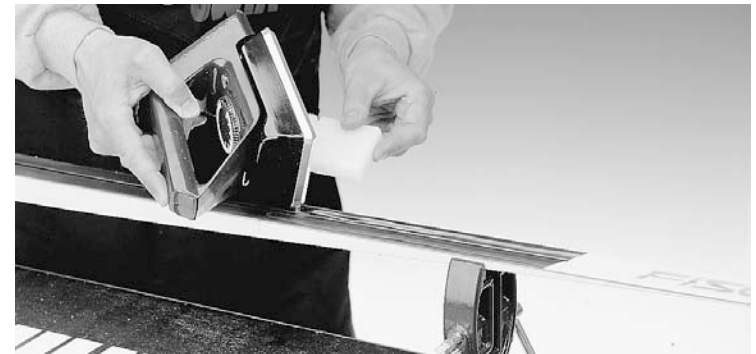


Michel de Montaigne (one of the most influential writers of the French Renaissance)

The hackneyed mantra

“The purpose of ski wax is to reduce adhesion forces, to reduce surface tension, and to prevent ploughing by adjusting the slider base hardness to the hardness of the snow. For example, by applying harder waxes the slider surface hardness is increased...”.^a

The same proposition we may find in thousands glide wax manuals and popular science articles.



^a KARLÖF, L., TORGERSEN, L. & SLOTFELDT-ELLINGSEN, D. (2005) Why is ice and snow slippery? The Tribo-physics of skiing. Oslo, Swix Sport AS.

Why skates are always very hard?

However, skaters newer ever have tried to improve glide on a soft ice (warm weather) by using aluminium (or brass) blades instead for steel blades. Why?



Skaters of the future?



Initial measurements

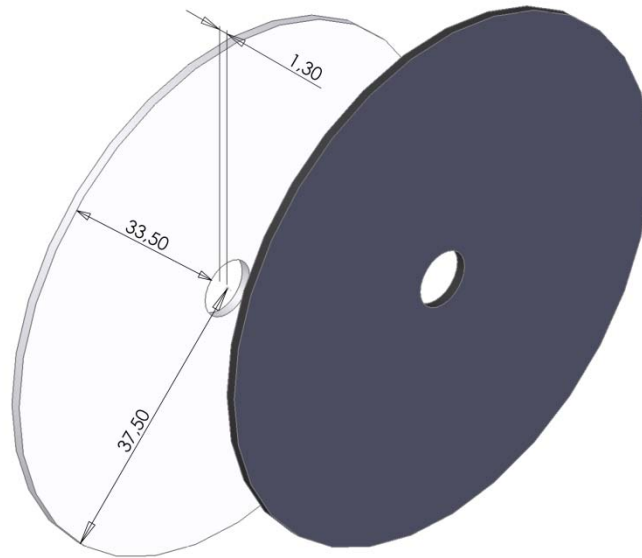
Before the experiment, we made Shore D measurements of tested materials.

Material	Hardness (Shore D)
P-Tex [®] 2000 Electra [®]	65,7 ± 0,7
P-Tex [®] 2000	64,8 ± 0,6
Glide wax NA8 (-8°/-20°C)	50,4 ± 3,3
Glide wax NA2 (0°/-4°C)	12,9 ± 0,8

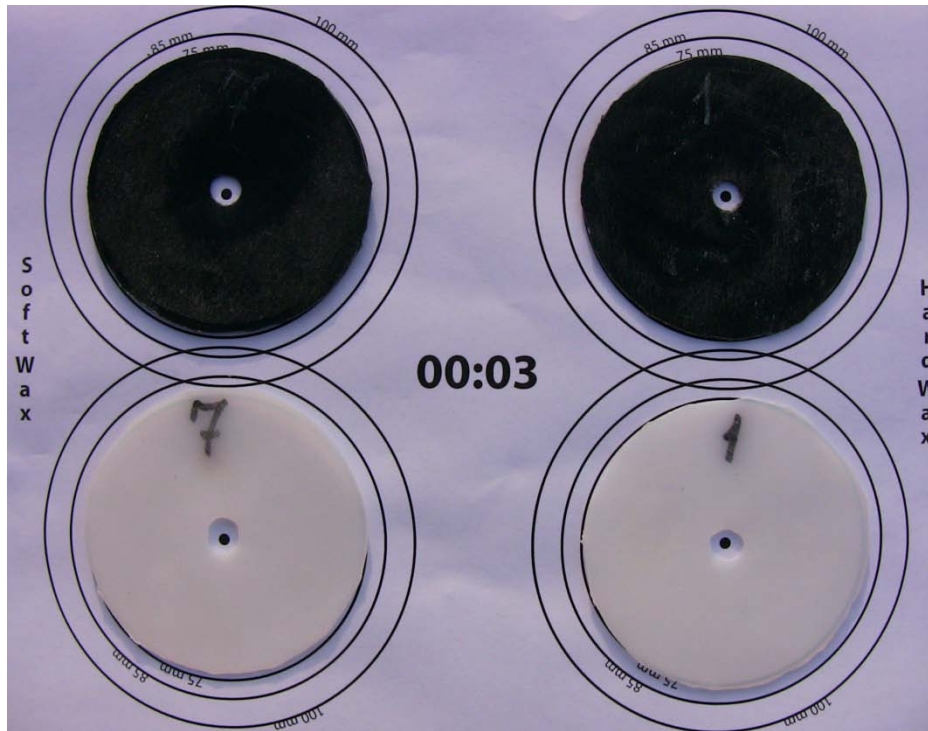
And surprisingly, we found that the hardest glide wax in the NA line is softer in comparison with ski base material.

Samples

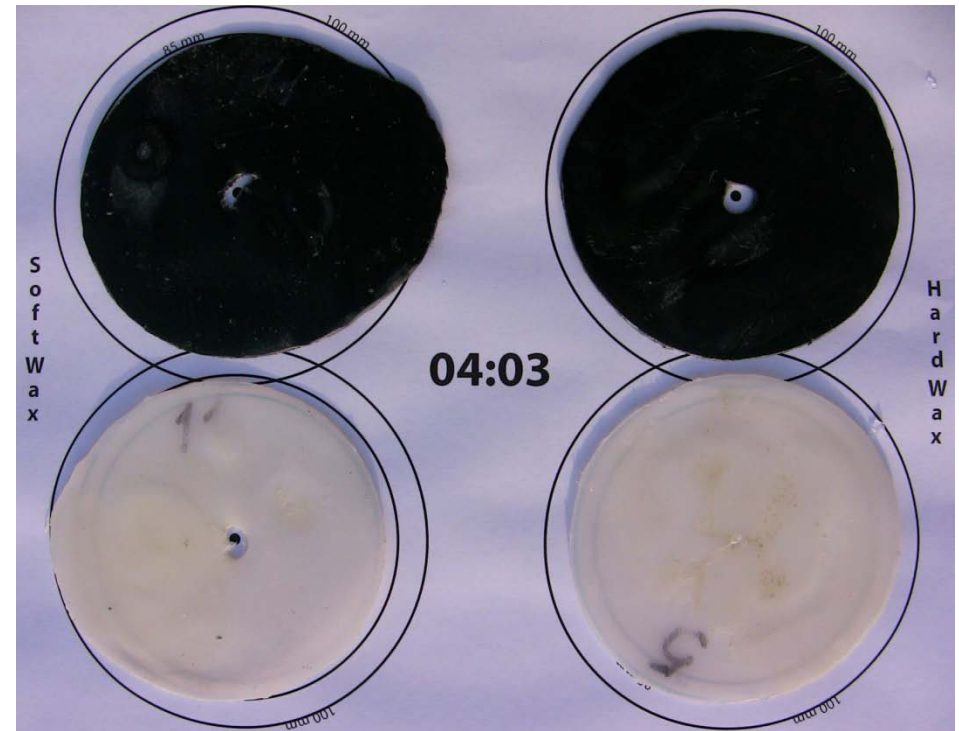
The transparent base samples were made from P-Tex[®] 2000 – a pure UHMWPE. The “graphite base” samples were made from P-Tex[®] 2000 Electra[®]. The “graphite base” is a mixture of UHMWPE and amorphous graphite (black).



Bathing in the molten glide wax



Specimens after three minutes in the molten glide wax bath ($119^{\circ} \pm 2^{\circ}\text{C}$)

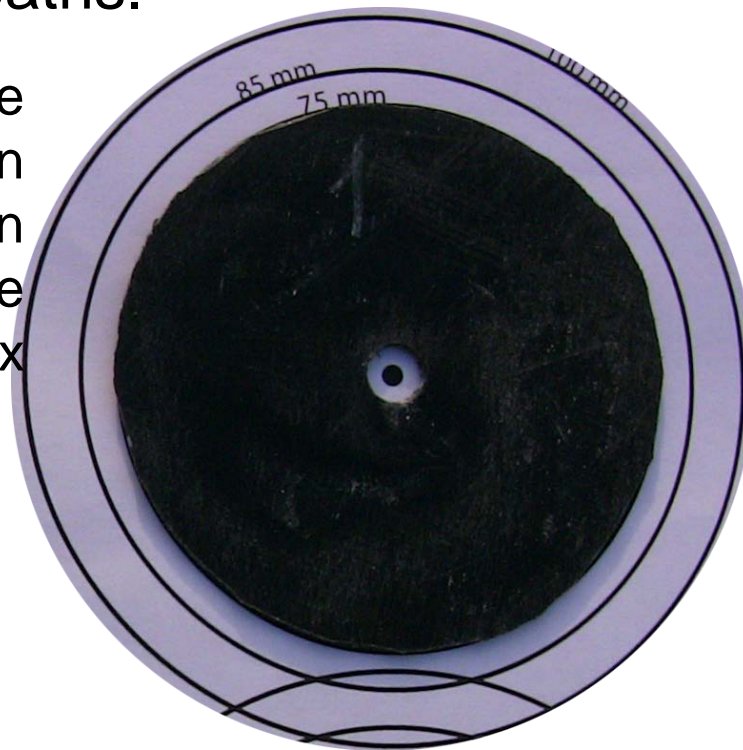


After four hours and three minutes

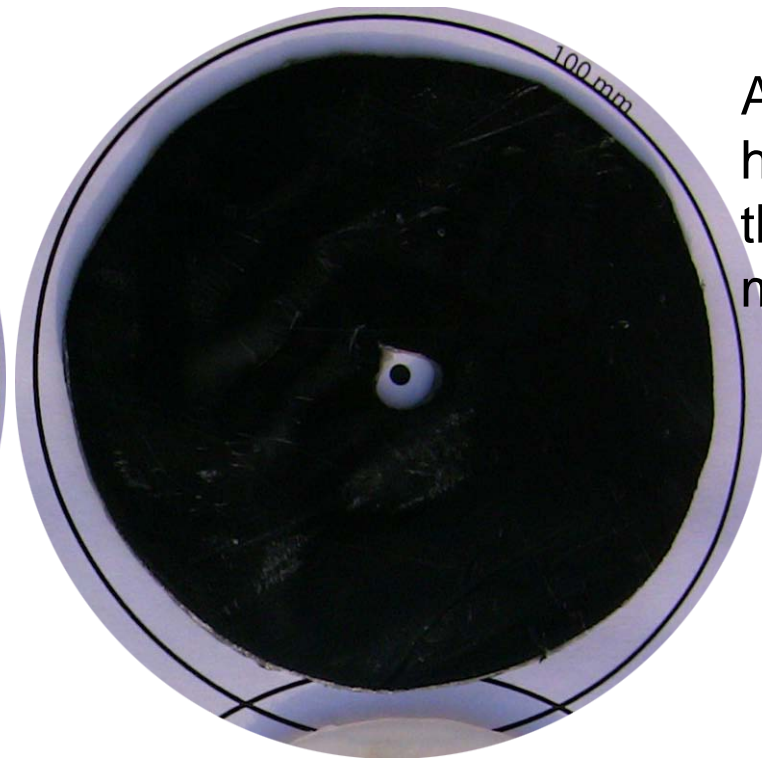
The swelling can be clearly observed

Even with the naked eye, it was possible to see how the specimens changed after treatment (dipping) in the molten glide wax baths.

After three minutes in the molten hard glide wax



After four hours and three minutes

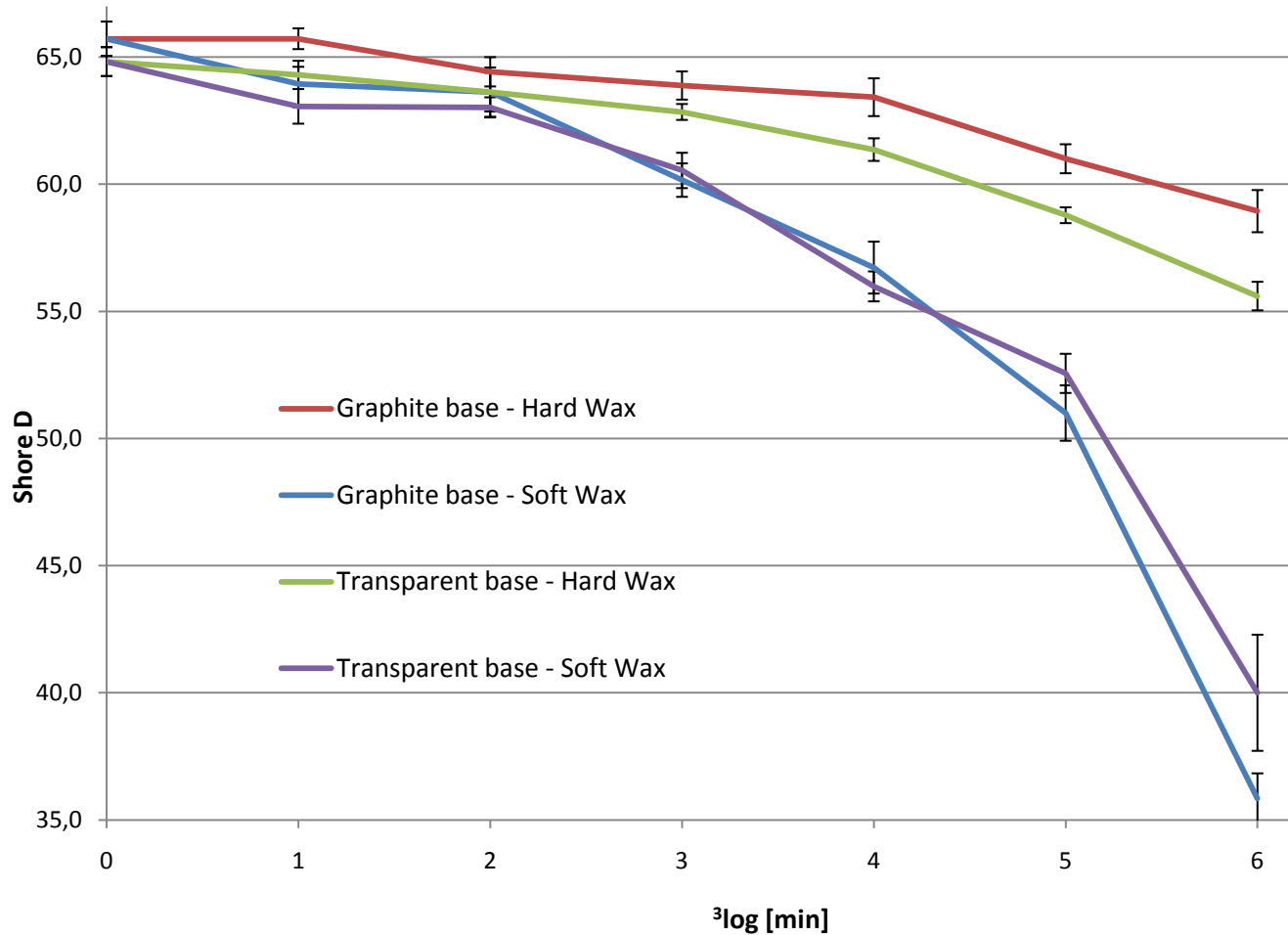


“There are no “pores” ...”

Obviously hot wax treatment influences the glide surface hardness and the observed results are assumed to be due to a **dilution** process. We would not describe this process as “impregnation”, “penetration”, “absorption” or “saturation”. All such terms imply some kind of ski base porosity, in which we don’t believe. Urs Geissbühler (Research & Development Manager, Gurit (Ittigen) AG): “There are **no “pores”** in press sintered UHMWPE as some wax manufacturers have been telling people over the last 40 years.”

For details: <http://www.escnordic.org.uk/myths/pores.htm>

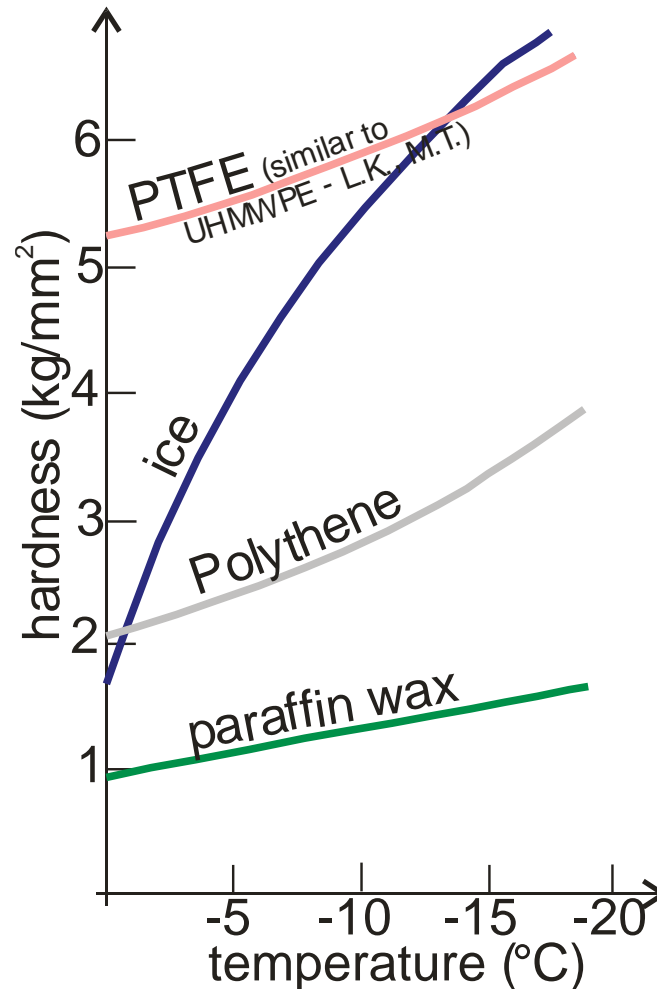
"Adjusting" or merely softening?



SRS hardness in relation to period of dipping in the molten glide wax bath

UHMWPE is hard enough

In the light of our results, it seems to be more effective to use a completely unwaxed, optimally machined ski base for cold dry snow conditions (aggressive snow).



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BOWDEN, F. P. (1953)
Friction on Snow and Ice.
Proceedings of the Royal Society of London. Series A, Mathematical and Physical Sciences, 217, 462-478.

Merci de votre
attention.