www.autosock.com

AutoSock

...brings you home!

Friction

Content:

Tribology/ Dry vs. wet friction

Tribology is defined as the sience and technology of interacting surfaces in relative motion and of the practices related therto.

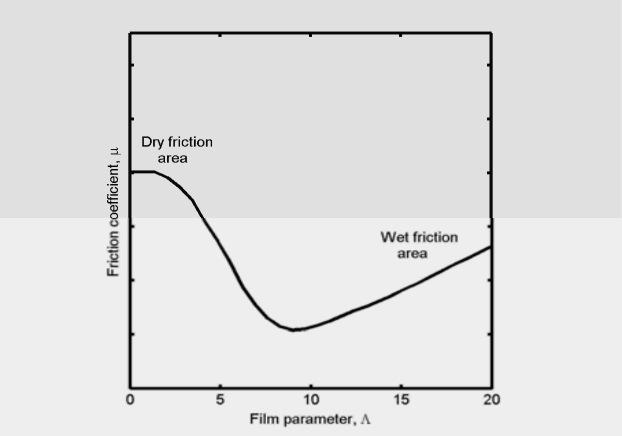
A tribological system consists of three parts:

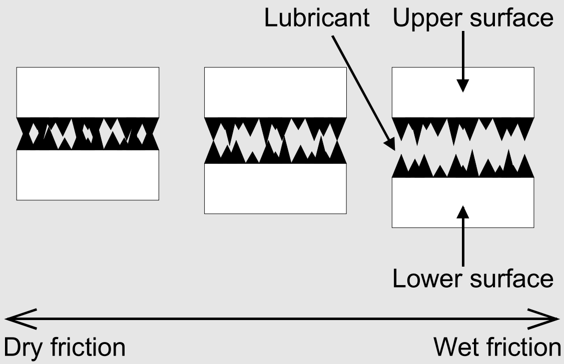
- Upper surface
- Lubricant
- Lower surface

In the case of friction on icy or snowy roads the **upper surface** is the tyre or AutoSock, the **lubricant** is water film created by frictional melting and liquid layer on the ice/snow, and the **lower surface** is the icy or snowy road.

When the water film thickness is insignificant, we have dry friction; this is the case when braking a car at -20ºC. When the water film separates the two surfaces, we have wet friction; this is the case when a car water planes.

Image





Regarding the AutoSock we intend to have as large area as possible under the AutoSock with dry friction, since dry friction gives the highest friction coefficient.

Snow vs. ice friction

The AutoSock has:

- A surface pattern that makes the total contact area exposed to friction sufficiently large under both soft and hard snow or ice conditions

- A combination of surface pattern, strength and elasticity that make the contact points sufficiently sticky under hard snow or ice conditions

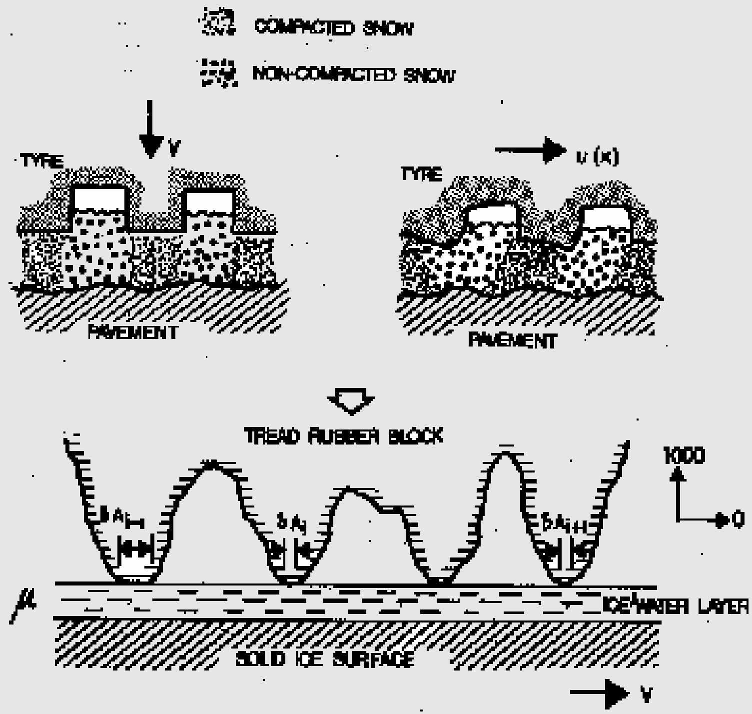
To some extent we have a trade off between good friction properties on snow relative to ice. It is favourable to open up the structure in order to increase the total contact area exposed to friction on snow. At the same time the contact points need to be sufficiently sticky on hard ice.

Image

The contact configuration of a tyre or AutoSock can be quite different on snow relative to ice.

The upper figures show the contact configurations of a tyre on soft snow.

The figure to the *left* simulates compaction resistance, while the figure to the *right* simulates impact resistance.



The lower figure shows the contact configuration of a tyre on ice where the macroscopic impact and compaction resistances are negligible.

Electrical parameters

Electric fields develop during ice/snow friction due to frictional self-electrification. The friction caused by electrostatic charging can be optimised by intelligently choosing a material with optimum electrical parameters.

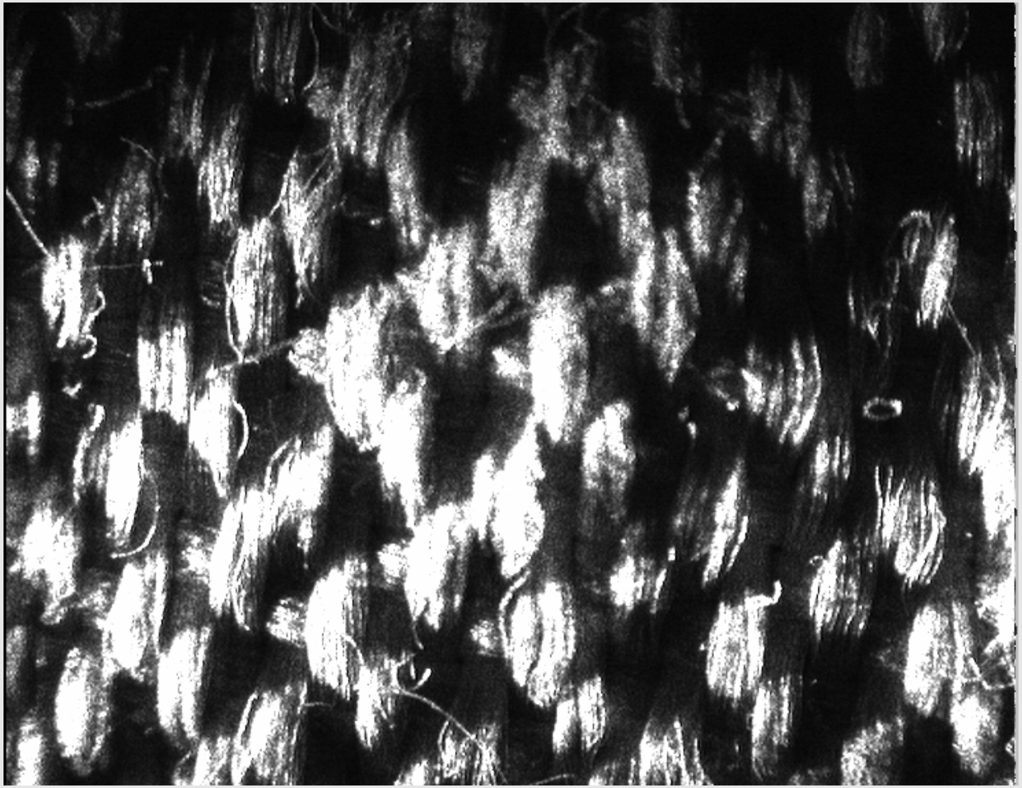
More to come when updated.......

Friction properties on ice & snow

A first generation AutoSock has been developed with good friction properties both on ice and snow. The AutoSock is characterised by:

- A specially designed surface pattern that makes the total contact area exposed to dry friction as large as possible both under dry and wet snow or ice conditions.
- Hairs between and at the contact areas in order to increase the total contact area exposed to friction.
- A surface pattern that makes the total contact area exposed to friction sufficiently large under both soft and hard snow or ice conditions.
- A combination of surface pattern, strength and elasticity that make the contact points sufficiently sticky under hard snow or ice conditions.

Image: AutoSock surface



Development of friction materials

The story

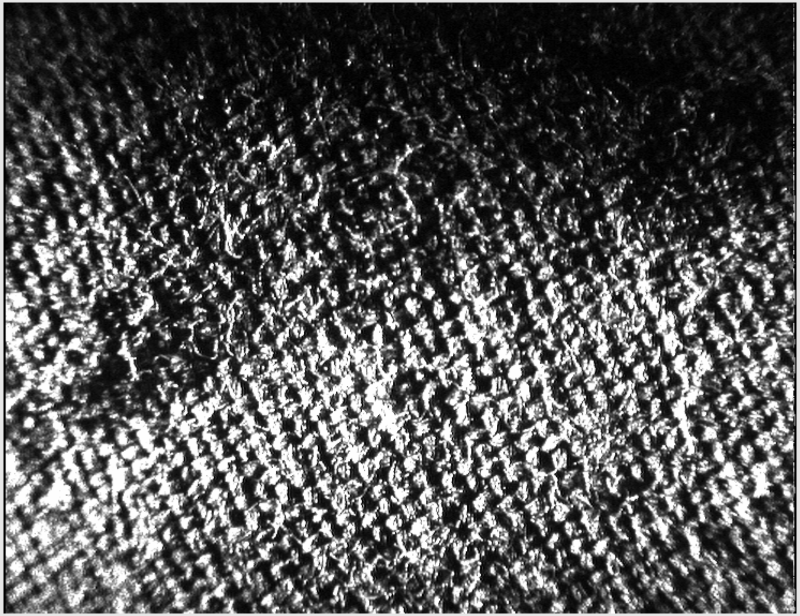
When Henry Ford had problems getting his car going under ice/snowy conditions, his wife used to lay a carpet in front of the tyre, and Henry got going. The idea behind the AutoSock has been to use textile in a similar, but more efficient way. One day Bård Løtveit found out he should friction test his own cotton shirt, and the friction properties turned out to be surprisingly good.

Was it possible to learn something from the cotton shirt?

We put Bård's cotton shirt under our laser microscope, furthermore we found the idea of making AutoSock out of a special textile fabric; polyester. Polyester is an interesting high friction material according to new theories on the effect of electrostatic charging and pressures on friction.

Native cotton fibre

The image is the **cotton fibre** of Bård's shirt under a microscope. We can see that the contact areas of the cotton surface are small and dense and that the total contact area is relatively large. Hairs on the cotton surface increase the totally exposed contact area to friction.



Rubber summer tyre vs. Properties on ice

This image shows a **summer rubber tyre**. This ahas a large total contact area and small flexible points.

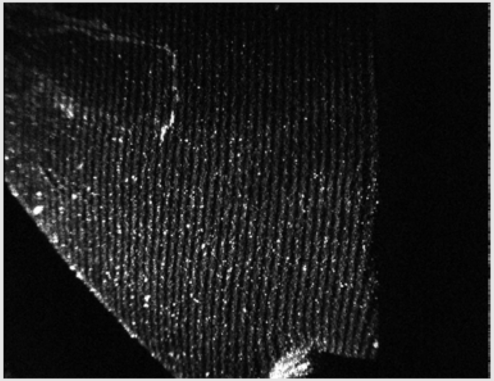
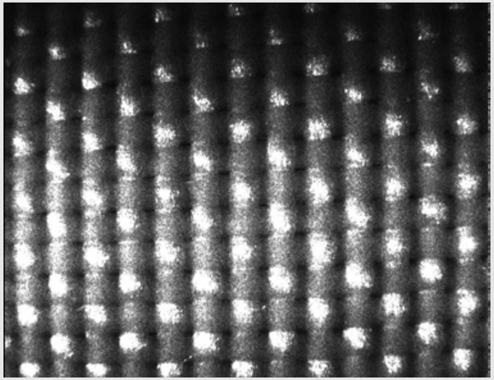
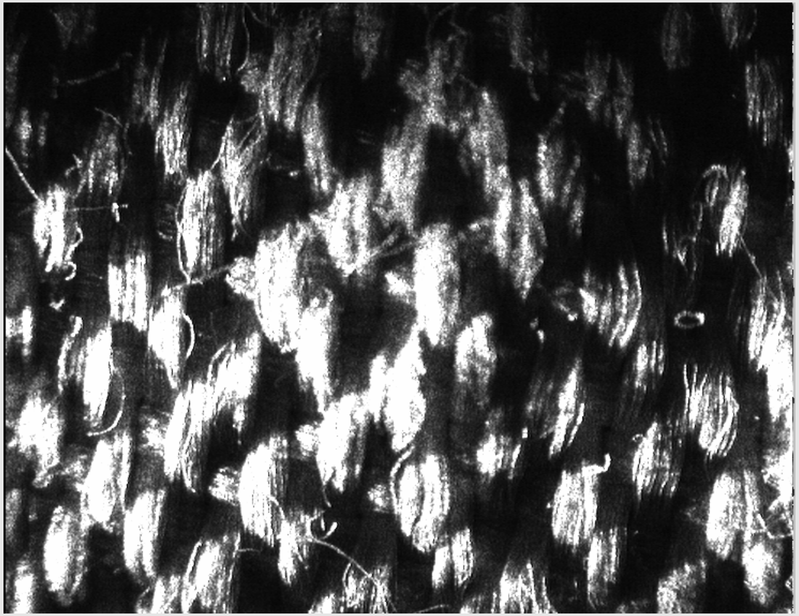


Image shows a sock with **poor friction properties on ice**. It can be seen that the totally exposed contact area to friction is to small for this sock under hard snow or ice conditions

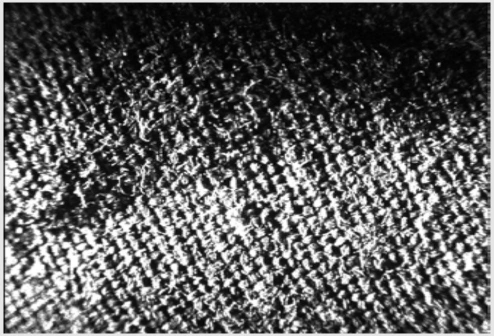


First generation AutoSock

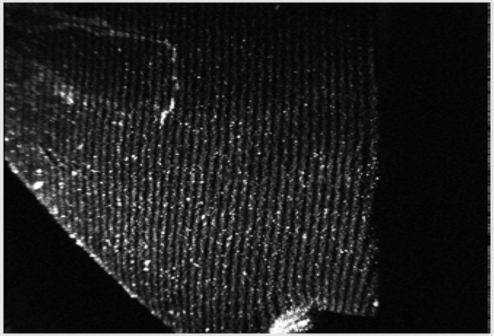
The contact areas of the **first generation AutoSock** in the image are larger and stickier than the other sock. The grooves and roughness given by the surface pattern exposes the sock to more snow under soft snow or ice conditions, and increases the totally exposed contact area to dry friction under wet snow or ice conditions. At the same time the totally exposed contact area to friction are larger under hard snow or ice conditions than the prevous sock. The hairs between and at the contact points increase the totally exposed contact area under all snow and ice conditions.



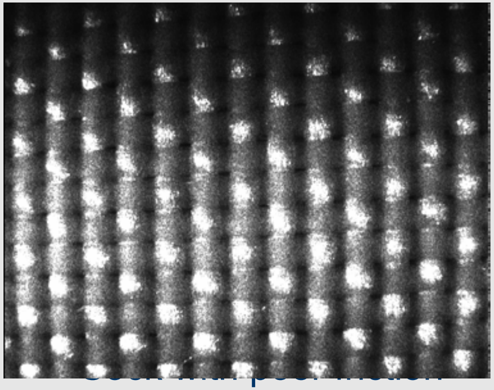
Pictures



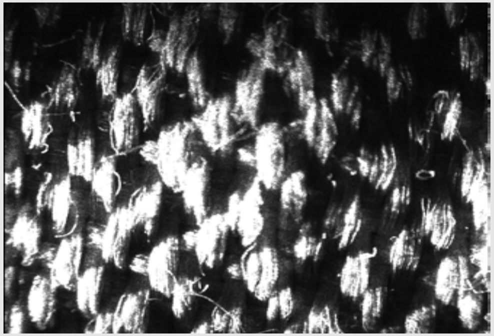
Native fibre



Rubber summer tyre



Sock with poor friction properties on ice



First generation AutoSock

References

- Moore, D.F. (1975): The friction of pneumatic tyres.
- Elsevier
- Amsterdam
- The Netherlands