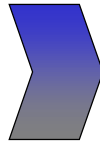




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Material for mountaineering ropes from the past to new ideas

Conference Turin, March 8/9 2002

Nylon and Ropes



Erich Kurzböck,
Technical Consultant

Materials for mountaineering ropes, from the past to new ideas

For more than 25 years, I have been confronted with the development of ropes. During this time, many things have happened and components and parts have been consequently developed to increase the safety of the climber and this represents the current technical status of technology" today .

If we look back at the past, we can see that ropes and rope applications have always been used. The uses varied and covered many end-uses such as agricultural, marine and military applications. During this period only natural fibres were available The use of ropes in the field of personal safety and climbing protection is a very young application.



In earlier times the technology applied was limited by the technique of twisted and hand made braided ropes. In the 50s the first serious development of safety- and sport-ropes was launched and in Europe twisted rope construction was changed completely to braided core-mantel ropes.

Coming from natural fibre hamps with an excellent touch, the development goal was accomplished by making improvements as a result of adding polyamide multifilament fibres to the hamp fibres. Step-by-step the use of fibre components of pure polyamide fibres for dynamic safety and climbing ropes was changed . Today this material is approved for use. In Europe the main construction is based on the core-mantel rope. It is a rope with an outside coloured sheet and a twisted or braided core inside.

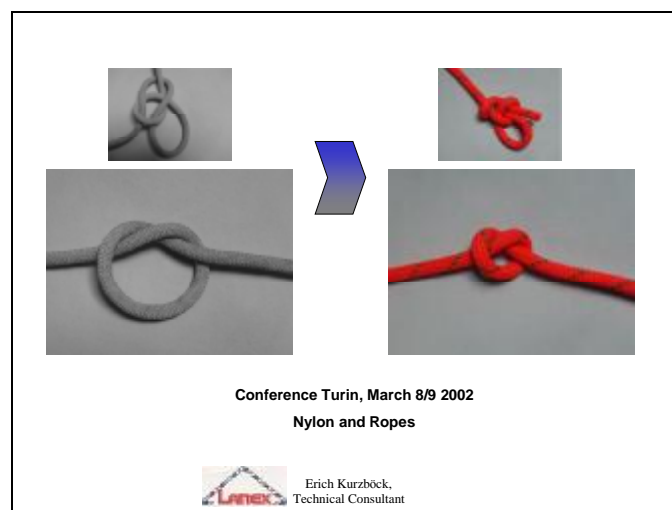
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Maybe the first application trials are still remembered by some experienced climbers since they were "a disaster" if the ropes got wet. 'The rope was moulded to a steel wire rope. The extremely stiff rope had a bad touch, a lot of kinks and did not run through the belaying system.

Standards were determined by the UIAA.. This gave rise to a series of developments concentrating on making the rope friendly to handle and reducing frequent rope breakage at this time. The improvement in the safety of these ropes represented a marked improvement for climbers.

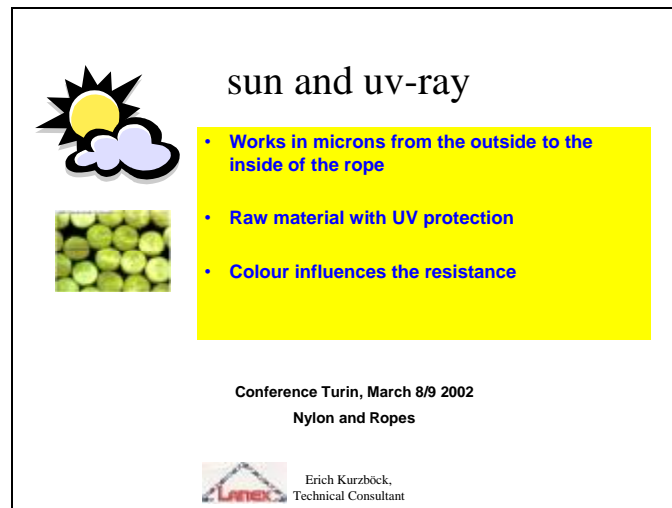
Essential safety parameters were recognised and converted to current standard technical products. The following points describe the main safety properties, reflecting the basic knowledge available, and explain the connection to the ready rope .



1. Stiffness/ softness of polyamide if the rope gets wet

- standard for measurement are available
- today a good raw material is on the market
- production technology is available especially in pre-finishing processes

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The slide features a sun icon with rays and a cloud on the left, and a small image of green rope strands below it. The title 'sun and uv-ray' is centered at the top. A yellow box on the right contains three bullet points. At the bottom, the conference details and the Lanex logo with the name 'Erich Kurzböck, Technical Consultant' are displayed.

sun and uv-ray

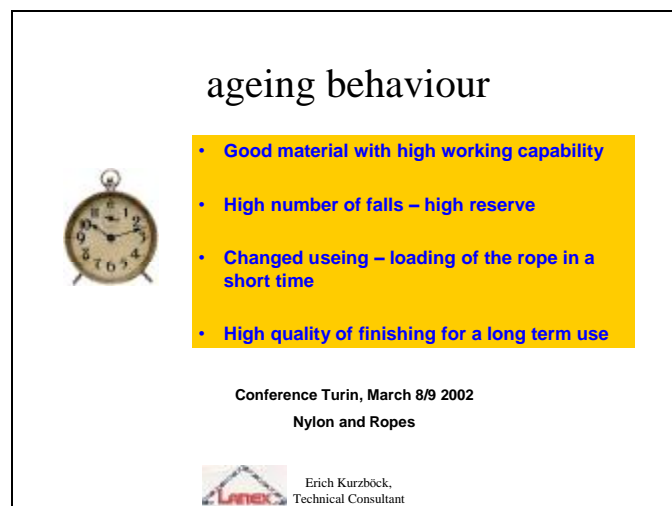
- Works in microns from the outside to the inside of the rope
- Raw material with UV protection
- Colour influences the resistance

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2. Influence of UV sun.

- knowledge that UV is working only in microns from the outside of the rope to the inside of the rope
- raw material with UV stabilisation is available and this is used in the mantle sheet
- colour can influence the loss of tenacity and resistance of the rope




The slide features a pocket watch icon on the left. The title 'ageing behaviour' is centered at the top. A yellow box on the right contains four bullet points. At the bottom, the conference details and the Lanex logo with the name 'Erich Kurzböck, Technical Consultant' are displayed.

ageing behaviour

- Good material with high working capability
- High number of falls – high reserve
- Changed useing – loading of the rope in a short time
- High quality of finishing for a long term use

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3. Improvement of the ageing behave of a climbing rope

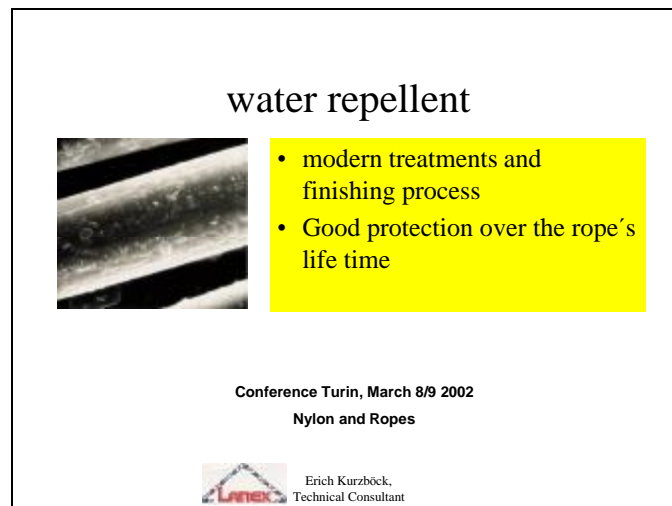
- today a better raw material with a higher working capability is available
- out of the high reserve of the number of falls the safety is enough over the ropes service life
- the end uses and applications for the ropes differ – the loading of the ropes in a short time is very high
- the quality of the finishing of the ropes is in a good range for long-term use.

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4. High number of dynamic falls

- today a good raw material is on the market
 - a steady material with a high working capability is available
 - low deviations in the production process and using modern machine devices
 - homogenous dyeing process especially the parameter of the working capability with a wide range of colours
- using right braiding machine in combination with the yarn-count



5. Safety with water-repellent rope.

- modern treatments and finishing processes to reduce water absorption are known. This protects the rope in the case of rain, snow
- these treatments work in a way that only the hollow places between the fibre bundles keep water inside.
- the ageing behaviour of this treatment is very good over the rope's life time
- when it comes to the price - climbers do not want ropes with a water resistant treatment since they climb only when it is sunny since this is more motivating

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There is still a demand for polyamide manufacturers because the material loses its performance despite these a.m. treatment during long time storage in a high level of humidity or water. As known a high deviation when conditioning the rope can influence the test result till 2 or 3 dynamic falls . This point is often discussed if we talk about conditioning textile materials and especially ropes. One of the reasons could be the changed molecular structure caused by finishing processes. . There is also demand to increase the side pressure tenacity in general and especially in wet conditions.



6, Resistance to sharp edges

Fibres are stressed crosswise, or if the rope is used in a knot or stressed over a sharp edge.

This is also still a weak point in the performance of a climbing rope. Furthermore, there is no standard for testing. We as rope producers should be interested in the establishment of a standard as soon as possible. We have also to clear up which kind of edge would be the right one. On the other hand we have to analyse the broken fibre ends under the microscope and compare this with different edges. With these figures we can find out the reason for the rope breaking over the edge. Is it overloaded, or cut or is there another reason?

At the moment some solutions are on the market to give the climber more safety when using a climbing rope in dangerous sharp edge situations. One solution is the use of 2 ropes together like a twin rope technique. The other one is performed by special durable rope constructions . These improvements increase the safety for the climber, but frankly speaking there are still limits and no rules in the standards.


To put it in the words of Pit Schubert. "It is possible to fly to the moon, but it is not possible to develop a rope which will not break over a sharp edge.

We have to blow air in this fire so that the flame will grow.


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costs

- Developments of fibers are expensive
- We are working in a small specialist field
- Question of quantity
- Nobody knows the result



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In this juncture I would like to report on an experience to give you food for thought. This should make the situation clear with regard to the chances we have to develop fibre materials and the cost involved.

New developments cost a lot of money and if we think about fibre raw materials we have to know that the rope manufacturers are working in a small specialist field.

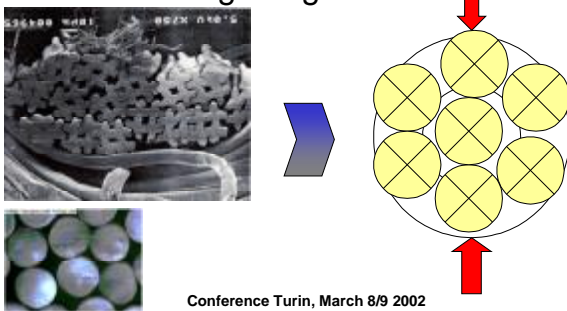
We think in different quantities. The fibre producer thinks in 1000 tons monthly and we talk in 1000 tons yearly.- Another question is will and can higher costs as a result of new developments be covered by the rope manufacturers respectively by the end consumer ?

If research shows a way to increase safety parameters and the fibre material is then available to all manufacturers there could be a chance to make changes.


New ideas for the development of new polyamide fibre material

Increase in the sensitiveness of the side pressure
we need fibres, priority polyamide, non sensitive in humidity and water
vision to use lighter fibres with the same capability as a hollow fibres
fibre with two properties in one
fantasies with new designs of fibre cross section
“grating fiber”, “gear-fiber”, “airbag-fiber”, “bicomponent-fiber”

grating fiber



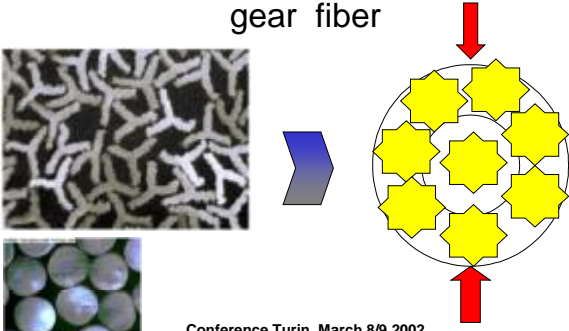
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gear fiber

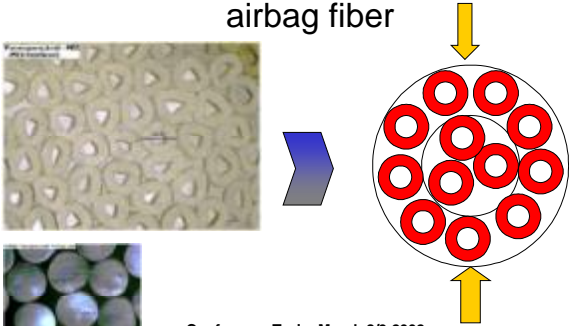


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airbag fiber

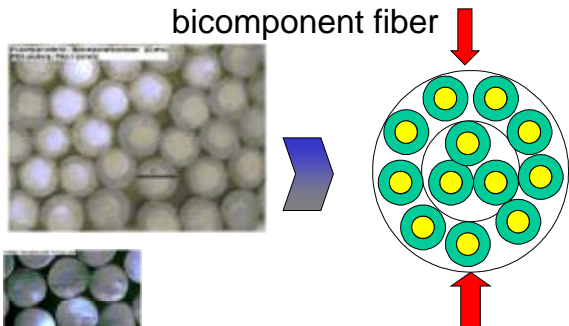


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bicomponent fiber



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Summary:

The UIAA and the work of other standards committees are largely to thank for the fact that today we have reached a technical level which works very well in practise as well as being tried and tested. There will continue to be further optimisations with the raw materials and production methods available. Further developments which also examine the question of raw materials such as polyamide take a long time. Ten years is not rare. But someone is bound to embark on this at some time. This conference and the work of the UIAA can , in my opinion, play an important role in the future and serve as a discussion platform for any relevant technical topics. Focusing on this can trigger off further developments which will promote the safety and comfort of climbers.

In the same way as a sharp edge test method was proposed several years ago, and is only now being discussed in greater detail, I could also imagine encouraging raw material visions amongst rope manufacturers and themes for the future amongst raw material manufacturers which would further promote safety.



I hope I was able to give some important insight into this field and I would like to thank you for your attention. If you have any questions, please fire away.