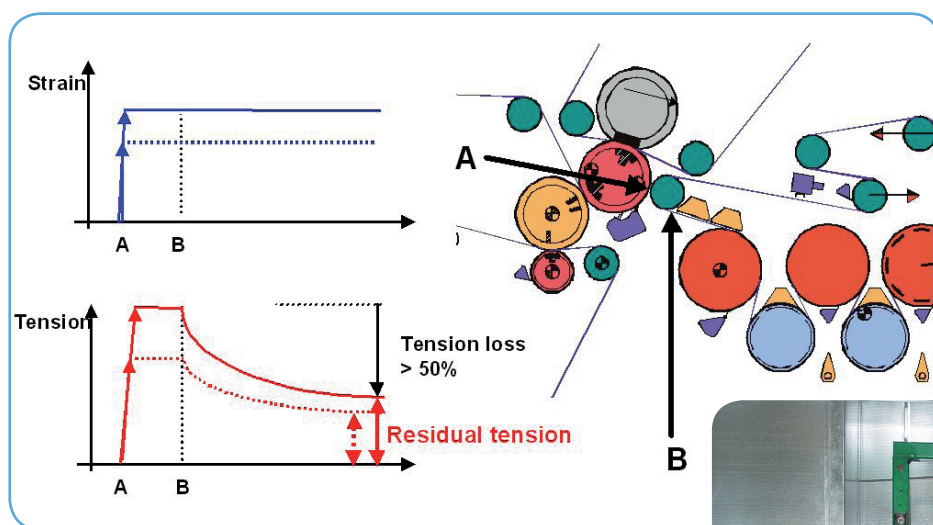


RUNNABILITY POTENTIAL MEASUREMENT OF WET WEB AT VTT



FAST TENSILE TEST RIG IMPACT

IMPACT is especially designed for wet paper tensile- and relaxation studies. The method enables reliable and repeatable tensile and relaxation measurements for wet and dry samples at high strain velocities.

This unique method gives an opportunity to estimate, for example, the effect of furnish composition, intensity and extent of refining, filler content and fibre properties on paper machine dryer section runnability.

RUNNABILITY AND WET WEB RHEOLOGY

The paper machine production speed (low grammage grades) is mainly limited by the wet web rheology in the open draws, especially in the press-to-dryer transfer area. At this position the dry solids content of wet web varies typically between 40...50%, which means that the tensile strength is only 10...15% of the strength of dry paper.



Typical characteristics of runnability potential tests

- Correlation between the results and PM runnability
- Dry solids content of samples varies between 25...96%
- Straining velocity 1 m/s
- Sample size (100...180)x(15...20) mm²

DECAY OF WET WEB TENSION

In open draws the (wet) web is transferred from one surface to another without support of wires. After the press-to-dryer transfer a certain tension in the web is needed to maintain a stable run through the dryer section. Due to low tensile stiffness of wet web substantial amount of draw is needed to guarantee sufficient tension. However more than 50% of this tension is lost due to rapid relaxation of the wet web. The remaining tension in the wet web determines its runnability in dryer section.

RELAXATION MEASUREMENT

In relaxation test the main parameters are the tension immediately after straining (maximum tension) and after a certain time (residual tension). Dry and wet web can be measured at several strain levels. Wet web relaxation properties of mechanical pulps are significantly better in comparison to chemical pulps. This is one reason why paper machines using wood containing pulps can have higher production speed than the ones using wood free pulp.

TENSILE STRENGTH MEASUREMENT

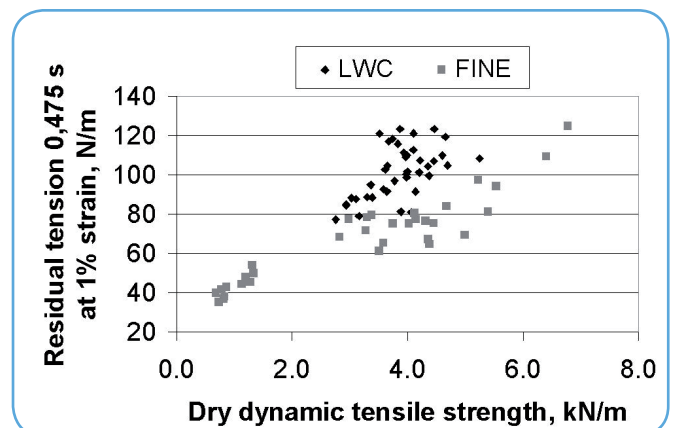
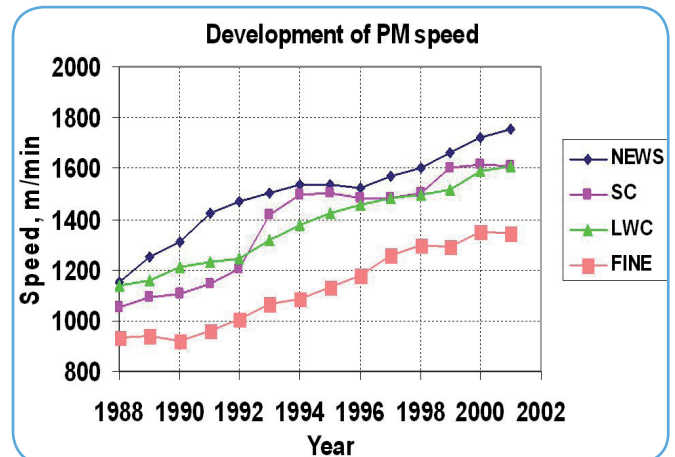
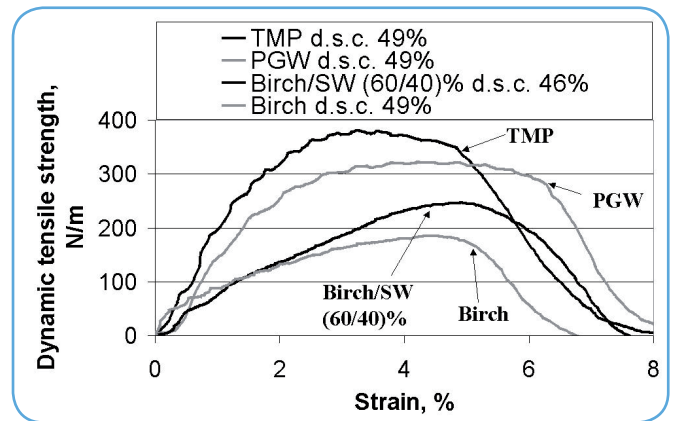
In tensile test the main parameters are tensile strength, elastic modulus, strain at break and tensile energy absorption. Stress-strain-curves of dry and wet papers differ significantly due to different failure mechanisms. Dry papers have a clear maximum tension at maximum strain but wet papers may strain several percentages without breaking after reaching the maximum tension.

The addition of mechanical pulp in pulp blends improves wet paper stiffness (elastic modulus) and tensile strength. Tensile properties of dry paper are typically improved by chemical pulp.

CORRELATION BETWEEN DRY AND WET WEB RHEOLOGICAL PROPERTIES

The tensile and relaxation properties of wet web are mainly determined by the fibre-water-fibre interactions: Fibre morphology, fines content, fibre surface properties of fibres and the properties of intercellular substance (water).

The rheology of dry web is mainly determined by fibre morphology and the amount and type of fibre-fibre bonds.



Summary

- The rheological properties of wet and dry web are determined by totally different mechanisms.
- By measuring dry paper properties it is impossible to estimate the behaviour of wet web.

Additional information

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