PowerBonds

Bridging between different scales

PowerBonds is a European project with a consortium of 15 partners from industry and science, amongst them five paper manufacturing companies. In each of the seven work packages several partners work on various tasks e. g. for providing specially prepared or modified fibres and developing together experimental methods and simulation models concerning fibre bonds and networks.

The project is coordinated by Tampere University of Technology. PTS is involved in most of the work packages and contributes in different ways to the project by supplying fibre samples using different modification and preparation techniques and providing sheet forming and physical sheet testing. Furthermore PTS develops techniques for single fibre analysis for modelling fibre bonds and networks, supports the project coordinator and leads one the work packages. ipw asked Timo Kuntzsch from PTS Heidenau about the progress of the project.

Timo Kuntzsch

ipw: Which are the biggest challenges of the project?

Timo Kuntzsch: One challenging task is to provide and to apply advanced experimental microscopy and mechanical characterization techniques to further elucidate the characteristics of fibre bonds. Different research institutes are concerned with their experimental set-up to adapt the methods to the particular needs of paper fibres. At PTS for instance the Dynamic-Mechanical Analysis (DMA) known from plastics technology is applied to paper sheets and single fibres. First measuring results showing the effect of humidity on fibre stiffness for single fibres already are available (see figure) that have to be proved and validated by performing further trials.

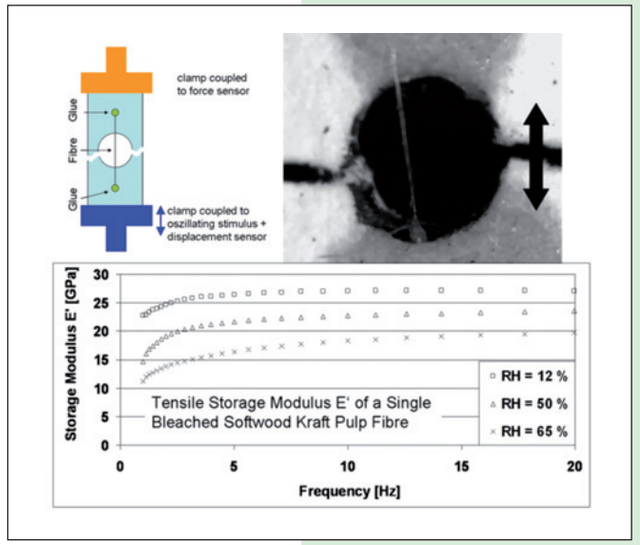
ipw: The projects duration is three years. When will first results be available?

The project's aim is to bridge between the different scales: from microscale investigations using microrobotics and other measurement techniques via simulations to the large scale industrial exploitation. The improved understanding of paper strength and its role in papermaking then will be used to derive conclusions on how to achieve stronger fibre bonds and thereby improved paper properties. The first project year is in particular focused on developing experimental and modelling methods.

Whereas first promising measuring results are already available in some tasks, further work has to be done in the second part on validation of measuring data and further development of simulation models. For the third year it is planned to investigate the transferability to industrial practice. In doing so relevant results will be generated successively during the project controlled by correspondent milestones.

ipw: In addition to testing properties of "normal" fibres, micro- and nanorobotic technology will be used for testing and analysing modified and functionalized special fibres and pulps. Where are the tests performed? What kind of modified and functionalised fibres could be used?

The preparation of specially treated fibre samples is carried out at Åbo Akademi University, and VTT, both Finland, and PTS and covers basic operations as screening, washing and refining of pulps and moreover fibre modification, e. g.



Measuring principle of Dynamic Mechanical Analysis and first results of single fibre characterization

polyelectrolyte multilayering (PEM) and adsorption of functional molecules and particles such as cationic and anionic cellulose derivatives, xylan and galactoglucomannans. The provided fibres and subsequent resultant fibre bonds and networks then are subjected to a thoroughly characterization concerning morphology and mechanical properties of individual fibres and fibre bonds. These time consuming experiments will be conducted at seven research institutes and merged together to make available a comprehensive knowledge of fibre bond characteristics.

ipw: What new insights are expected from these experiments?

Micro- and nanorobotics technology is a novel approach for characterizing fibres. These techniques have proven to be very useful in many application areas such as living cell characterization, semiconductor and nanomaterial characterization, and micro-assembly. Despite the extensive research activities in other application sectors, micro- and nanorobotics are in their infancy in fully unstructured organic materials, especially in the pulp and paper sector. In this project, this novel technology will be used for providing fibre scientists and developers with new experimental insights to the mechanisms of fibre bonds.

The main expected outcome from the approach is to answer the questions "What should we measure to predict paper performance in the end-use applications?" and "How can the performance be improved at the lowest cost"?

ipw: The project aim is to create added value for paper products. How fast the papermaking industry might benefit from the projects outcome?

To ensure a fast transfer of research results towards a practical application special emphasis is given to industrial interests: in addition to one work package dedicated to the "Demonstration of industrial applications" the entire project is accompanied by five paper-manufacturing companies. These partners are contributing by providing critical needs and existing challenges in their operations in the early stage of the project. They will also use the tools and implement the solutions developed in the project to resolve nagging issues in their production and end-use. By these means an efficient transfer is aspired, hence paper industry can benefit from the projects outcome very fast. ___ S. Haase

Further information: www.wwnet-powerbonds.eu