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**Research area: Process aims**

Pulp production // Pulp treatment

**Key words:**

Reactive extrusion, thermoplastic, surface modification

**TITLE:****Novel fiber bonding mechanisms for moldable products****Background/Problem area**

Nowadays ecologic, technologic and economic situation emphasizes demand on thermoplastic fibers and thermo-moldable paper based materials. However, original cellulose fibers are not thermoplastic and papers thereof are not thermo-moldable. The reason for it lays in the fact that single cellulose fibers are bound with each other upon ionic and H-bonds whereas thermoplastic polymers are bound upon much weaker van der Waals linkages allowing easy movement of polymer chains relative to each other. Therefore, a way to bring thermoplastic properties to cellulose fibers is their surface chemical modification. Upon such a functionalization, ionic and H-bonds between fibers should be partially substituted for van der Waals linkages. Thereafter, paper sheet forming and its thermo-molding should be allowed.

State-of-the-art technologies of fiber modification implicate low-consistency reactions and long reaction times. Creating a technology and market relevant process, aforementioned constrains should be overcome. In the current project, reactive extrusion is applied for carrying out high-consistency solvent-poor or solvent-free chemical treatment of cellulose fibers.

**Objectives/Research results**

The objective of the research project is to provide thermoplastic properties of cellulose paper sheets upon fiber modifying with thermoplastic additives and reactive substances. As a result, paper thermo-molding should be facilitated and the dimension stability should be enhanced.

Following goals should be achieved:

- to investigate the influence of the extrusion treatment on fiber properties (fiber length, moisture sorption);
- to carry out solvent-less or solvent-free heterogeneous chemical modification of cellulose fibers with various reactive agents by reactive extrusion;
- to modify carry out surface modification of cellulose fibers with thermoplastic polymers by co-extrusion;
- to evaluate the applicability of the modification procedures aforementioned for producing thermoplastic / thermo-moldable paper products.

**Application/Economic benefits**

The developed methods of fiber modification should open new ways to up to date inaccessible or hardly accessible applications like thermoforming. It may thereafter open new opportunities for producing packaging and special paper with completely new properties beyond the reach of current paper products like semi-transparence, high dimensional stability, and thermal stability. Furthermore, partial substitution of fossil-based materials (for instance, polyethylene and polypropylene films and containers) may be allowable.

**Period of time: 01.12.2013 – 30.11.2014**

**Remarks**

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