Nanofibrillated cellulose as carrier of (nano) particles

Jämsä Saila • Kataja Kirsi • Vastamäki Pertti • Putkisto Kaisa • Takala Soili, VTT Technical Research Centre of Finland

Dyhr Henrik, Teknos Oy

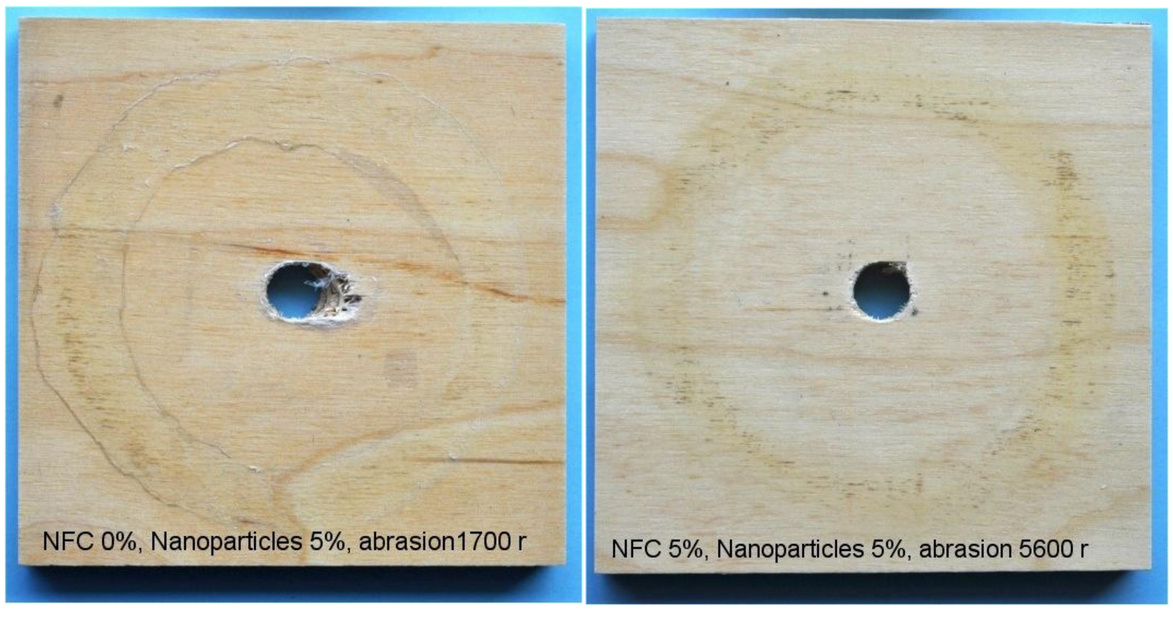

Figure 1: Birch veneer coated with nanoparticles (5%) containing lacquer but not nanofibrillated cellulose (NFC) lasted 1700 rotations of abrasion before the surface wore away. Same lacquer with NFC (5%) and nanoparticles (5%) lasted 5600 rotations.

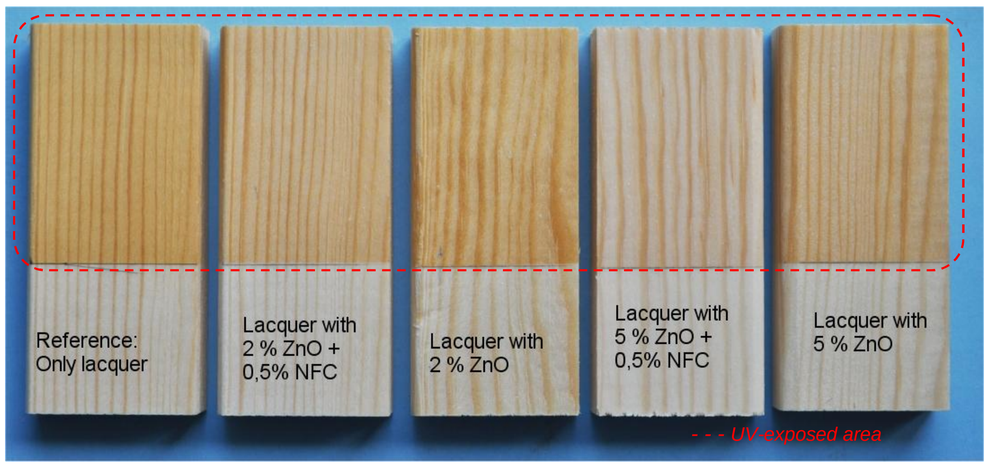

Figure 2: UV-durability of coated pine wood samples. Nanofibrillated cellulose (NFC) enables the effective use of inorganic nanoparticles by stabilising the coating dispersion.

Objectives

The objective of this NASEVA subproject was to screen the potential of nanocellulose based materials to be used as additives in process industry. The carrier properties of nanofibrilled cellulose (NFC) for the paint additives was studied

- to increase UV-durability of the lacquer with inorganic nanoparticles
- to improve abrasion resistance of the lacquer

Materials and methods

The materials used were wet NFC (1,6 % gel, produced by fluidiser operated by Finnish Centre for Nanocellulosic Technologies, FCNT) and water based model polyurethane lacquer delivered by Teknos Oy.

Inorganic nanoparticle dispersions and solid nanoparticles were used for UV-durability tests. The amount of nanoparticles was 1 - 5 w-% and the amount of NFC was 0.5 w-% calculated from the solids content of the lacquer. Pine samples were used as substrates for coatings. The wet spreading amounts were 130 g/m^2. The specimen were exposed to UV light and the colour changes were measured by means of a spectrophotometer (a Minolta 525i).

NFC (0-5%) and silicananoparticle dispersions (2,5 or 5 w-%) were added to the lacquer. Birch veneer substrates were coated by brushing several layers of coating mixture. The dry spreading amount was 100 g/m^2. The abrasion resistance was measured with Taber Rotary Platform Abraser 5135.

Results

Nanofibrillated cellulose (NFC) improved abrasion resistance of the lacquer containing silica nanoparticle dispersion, see figure 1. The abrasion resistance increased as the amount of NFC increased. In addition the adhesion between different coating layers was improved with NFC.

UV-durability of wood substrate is improved with inorganic nanoparticles, see figure 2. When nanofibrillated cellulose (NFC) was used as an additive, the inorganic nanoparticles were uniformly distributed in the lacquer matrix, and the dispersion was stable. This ensured the distribution of particles evenly on sample surface and thereby improved UV-durability. Without NFC the nanoparticles in dispersion deposited immediately to the bottom.

Acknowledgements

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