WEAR RESISTANCE OF UV-CURABLE OF WOOD WATER-BASED COATINGS WITH ADDED CELLULOSE NANOCRYSTALS

VARDANYAN Vahé, POATY Bouddah, CHAUVE Gregory, LANDRY Véronic, GALSTIAN Tigran, RIEDL Bernard

University Laval, Quebec, Canada

Abstract

There are several instances in the literature of nanocellulose-thermoplastic composites, but there are few studies on coatings reinforced by nanocrystalline cellulose (NCC). One of the key aspects in the technology of nanocomposites remains the dispersion of the nanoparticles within the matrix. To quantify the dispersion, efficient methods of characterization are needed. In this paper a new characterization method based on atomic force microscopy (AFM) is applied to characterize such nanocomposite coatings. The overall objective of the research is to develop nanoparticles reinforced UV-water-based coatings for wood applications, and to study the effect mainly on wear properties of the final composite coatings. Nanocrystalline cellulose was mixed with the coating formulation in order to improve the mechanical properties of the coatings. The coating formulations were sprayed on sugar maple boards, which were then placed in an oven to evaporate the water to finally be UV-cured. The dispersion analysis was done by AFM by measuring roughness. Elemental analysis was done to measure the amount of TiO2 white pigment in paint aggregates. NCC was modified by either alkyl quaternary ammonium bromides or acryloyl chloride. These new chemical functionalities did not induce deep structural changes in modified NCCs. NCC derivatives were better dispersed in aqueous acrylic coating as suggested by AFM. The modified NCC addition in coatings results in a ca. 30 -40 % increase in wear resistance (abrasion and scratch), without loss of appearance. When the reinforced varnish was applied to an opaque paint layer, rather than the wood, the same reinforcement took place.

Keywords: UV- water-based coatings; Nanocrystalline cellulose; atomic force microscopy; scanning electron microscopy; ultrasound

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