Nanoparticle Impregnation Treatment of Natural Fiber for Functional Biocomposites

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This research presents a novel *in situ* nanoparticle impregnation treatment of the lignocellulosic fibers for functional composite products. Unlike other synthetic fibers (glass fibers, carbon fibers, etc.), the cell wall structure of cellulosic fibers contains many micropores, where the nanophase can be easily deposited into. This technique takes advantage of the porous structure of the cellulosic fibers permitting the nanophases to be more evenly distributed into the resulted products. By the impregnation treatment of the cellulosic fiber with different nanophases (such as noble metals, iron, iron oxides, and etc.), the resulted products will present certain functions, such as magnetic, anti static, anti radiation, anti permeation, anti microbial, and etc. While directly impregnating the commercial nanoparticles into the cellulosic fibers can be difficult and costly, the *in situ* nanophase impregnation technique is to introduce the ionic liquids into the micropore structure of the cellulosic fibers consecutively. When a precursor applies at certain conditions (such as increasing the temperature), the impregnated chemicals react inside the micrpores of the fibers and to form the desired nanoparticles. The presentation uses the iron oxide nanoparticle impregnation as an example, describes a magnetizing process of natural fiber through the *in situ* nanoparticle impregnation treatment to create magnetic composite panel product for different applications, such as signal shielding panel. The presentation also discusses a novel magnetic activated carbon product through the *in situ* nanoparticle treatment technology.