

APPLICATION OF HIGH CONDUCTIVE NANOPARTICLES TO ENHANCE THERMAL AND MECHANICAL PROPERTIES OF WOOD COMPOSITE

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ABSTRACT

In the present work three different types of nanofillers such as multiwalled carbon nanotubes (MWCNTs), aluminum oxide nanoparticles and nanosize activated charcoal were mixed with UF resin and used in the preparation of medium density fiberboard (MDF). The process has improved heat transfer during hot pressing and achieved proper curing due to enhanced thermo physical properties of wood fibers. To improve the dispersion of nanofillers into UF matrix, high speed mechanical stirring and ultrasonic treatments were used. The MWCNTs were oxidized with nitric acid and the functional groups formed on its surface improved the dispersion and interaction with UF matrix. The dispersion of nanofillers in UF resin matrix was confirmed with XRD, FESEM, and DMA tests undertaken. The mixing of MWCNTs and Aluminum oxide with UF resin have reduced the curing time due to enhanced thermal conductivity of MDF matrix. The heat transfer during hot pressing of MDF improved significantly with the addition of MWCNTs and Al₂O₃ nanoparticle and activated charcoal did not have much effect on heat transfer. The curing rate of UF resin improved with all the three nanofillers, as the activation energy of UF curing decrease as shown by the DSC results. The physical and mechanical properties of MDF have improved significantly with MWCNTs and Al₂O₃ nanoparticle. The activated charcoal has significantly decreased the formaldehyde emission of MDF.