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Influence of Al₂O₃ nano particles addition on the mechanical properties of medium density fiberboards (MDF)

Gholamhossein Liaghat¹, Sadaf Karkoodi², Hamid Z Hosseinabadi³ and Hamed Ahmadi⁴^{1,4}Mechanical Engineering Fundation, England²Mechanical Engineering Fundation, Iran³Wood and Paper Science and technology Fundation, Iran

The importance of the application of composites in high-tech industries especially in aerospace and automobile industries have been improved nowadays due to their good properties such as high strength with respect to weight. Among different types of composites, wooden composites have a special importance in various industries due to their energy absorption as lightweight structures with modified ballistic capabilities. In this paper, the effects of alumina (Al₂O₃) nanoparticles on the mechanical properties of medium density fiberboards (MDF) have been reported. The thickness of boards and the percentage amount of Nano-alumina were considered as variables. In this research, the combination of forest and garden fibers, due to their excellent abrasion resistance, as well as their affordability and suitable price were used as a composite field, with Nano-Al₂O₃ powder (APS: 20nm) as a hardening phase for making the desired Nano composite specimens. The strength including internal bonding (IB), bending strength (modulus of elasticity in bending and modulus of rupture) (MOE, MOR), density, water absorption and swelling in thickness tests were performed on the specimens. The experimental findings show that the resultant properties of the new Nano wooden composites are higher compared to witness samples. The results indicated that increasing the content of Nano-particles had significant effect on the internal bonding as well as bending strength and modulus of rupture of panels. Increasing the thickness of the panels from 5 to 14 mm improved modulus of bending (47%), internal bonding (34%) modulus of rupture (27%). The greatest increase in modulus of bending was observed when 1% by weight Nano Al₂O₃ was added to the samples (10% increase in modulus of bending was observed). The addition of Nano Al₂O₃ particles resulted in an enhancement in MOR compared to witness samples. The maximum MOR had occurred for samples containing 1% Nano Al₂O₃.

libin@nudt.edu.cn