<<新型气凝胶型木质复合材>>

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内容概要

Nano technology and its applications in the field of wood science andtechnology recently have gained much attention, especially in viewof potential for wood modification by the processes of preparing wood-inorganic nano composites. This book reviews recent advances in wood-inorganic nano composite technologies and reports the work of fabricatingnano wood-inorganic aerogel composites by the sol-gel process andsupercritical drying techniques. This research systematically reviews anddiscusses technical principles of fabricating wood-SiO2 aerogel composites.Physical properties and morphological characteristics of prepared wood-SiO2 composites, distribution of SiO2 aerogel in wood and mechanismsof compounding between wood and SiO2 aerogel are also discussed.

This book can be used as a college textbook as well as a referencefor researchers in the fields of wood science and technology, woodmodification and wood preservation.

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章节摘录

Improving mechanical properties of wood is one of the most important aspects ofwood-based nano composites. Evidences have shown that use of non-metallic nanomaterials as fillers in plastic and rubber greatly improve mechanical properties. Themodification effects are attributed to great surface area of surface of nano particleswhich increases adhesion between nano particles and the polymeric matrix. It isexpected that the use ofnano materials would greatly improve mechanical properties ofwood. However, there is little accumulated data to support that expectation, andtherefore more research should be focused on this task.1.3.2 Wood Modification with Nano Materials for Environmental Effects Application of inorganic nano materials would be able to maintain theenvironmental properties of wood. Due to small sizes nano materials infiltrated into thecell walls react with cell wall materials and become part of the cell wall and thus ableto maintain the capillary system of the cell wall. Nano materials are ab e to createspecial surface properties to make the composite either super hydrophilic or superhydrophobic. The basic principle is by chemical means to construct nano-size andgeometrically compensating surfaces with nano materials. Strong adsorption of gases（or air） on the surface creates a gaseous membrane covering surfaces of the compositeblocking the adsorption and absorption of water or oil by the composite （Wang 2002）.It is expected that such technology would be able to increase greatly dimensionalstability of wood in which the surface modified by nano materials acts like a surfacecoating. In addition , the modified surface also would provide color stability andimprove acoustics properties. Therefore, it is significant to pursue such technology. Fumie and Saka （1998） fabricated Chamaecyparis obtuse wood-Si02 inorganiccomposites by incorporating biocide TMSAN in the system; the resulting compositeshowed very good resistance against brow-rot decay but was not resistant againstwhiterot decay. However, the composite prepared by the HFOETMOS-TMSAHsystem increased hydrophobicity of the composite, making the composite resistantagainst both brown-rot and white-rot decay.According to research in Japan, there are three basic methodologies to fabricatewood-inorganic composites with the sol-gel process. Firstly, it is necessary to controlthe moisture of wood; free water and bound water in wood should be removed and usesonly the water of constitution to provide water molecules to react with the solprecursors. The second method is to pre-treat wood with coupling agents so as to effectively cross-link metallic orgarucs to wood components for maximizing the effectsofimproving wood properties. The third is to incorporate fire retardants and biocides in the system and at the same time taking the issue of environmental impacts in toconsideration by carefully selecting benign chemicals.Research on wood-inorganic composites with the sol-gel process also has beenconducted in China. Wang （1996） fabricated wood-inorganic composites by the sol-gelprocess with TEOS. It is believed that portion of the Si02 gel condenses with celluloseand some fill the cell lumen, forming a net work of Si02 gel in wood. In the subsequentresearch that GPTMS was used as a coupling agent to increase linkage betweeninorganic Si02 and wood components in the cell wall through formation of Si-O-Siand C-O-C bonds and improves the overall property of wood, We believe in the above work Si02 nucleus formed in the cell walls of wood and growth of these Si02nucleus resulted in the wood-Si02 nanometer composite. Wang et al （2000） fabricatedhighperformance wood-Si-Al-composites with TEOS. ……

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