

Wood modification with titania and silica based precursors



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(Dr. Raven Ledner)

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Cuvillier Verlag Nov 2013, 2013. Taschenbuch. Book Condition: Neu. 211x146x4 mm. Neuware - This dissertation is devoted to explicitly investigate the suitability of titania and silica based precursors for wood modification. Novel TiO₂ / SiO₂ wood inorganic composites were prepared by two-step process. In first step, freshly prepared precursor solutions of silicon and titanium alkoxides were vacuum impregnated (one or more cycles) to oven dried pine sapwood (*Pinus sylvestris* L.). Precursor solutions with nano-scaled species and particulates (TiO₂ and SiO₂) were soaked by the entire wood matrix during this step. In (second) subsequent curing step, these penetrating liquids transformed into respective gel layers and depositions therein by sol-gel processing (in-situ hydrolysiscondensation). Sol-gel based depositions were evenly covered on the cell walls in the form of thin layers. These gel films were not crack-free however; very few cracks were visible in the gel coatings present within the wood matrix of composites prepared with precursors of low alkoxide content. In addition, the gels were randomly distributed, found to be mainly deposited in the wood cell lumen and also localized in the cell walls as ESEM-EDX mapping revealed. The impregnated samples show an increase in mass and volume expressed as eight percent gain (WPG) and bulking (B). Both of the parameters are decisive for tailoring a number of physical properties of the resultant composites. In general, moisture and water sorption capacities were decreased by 43 to 50 % while antiswelling efficiency (ASE) and bending strength (MOE) of the precursor-modified wood (composite) were increased up to 34 % and 41 % respectively, when compared to unmodified wood. These improvements are attributed mainly to gel depositions in the wood structure that physically interact with the wood matrix consequently narrowing the main flow passages there and reinforcing strengths of the fiber. These materials show superior resistance...

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