Technology market
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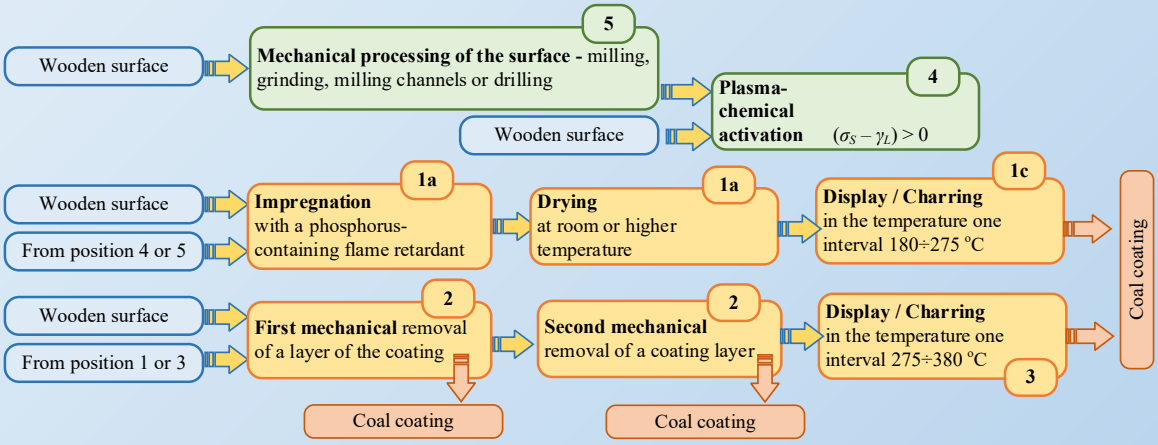
Method for obtaining black decorative coatings

Peter Dineff, Dilyana Gospodinova

Technical University of Sofia has created a technique for applying black (carbon) ornamental finishes to the surfaces of wood, cellulose, and related products, such as boards, beams, plywood, cardboard, paper, and more, through chemical carbonization. This innovative method has been granted a patent in Bulgaria.
Application № 112941



Classical techniques typically involve achieving black (carbon-based) decorative coatings through the use of surface thermal processes such as pyrolysis and flame charring of wood at temperatures within the range of flame combustion (280°C to 450°C). However, several challenges must be addressed, including the need for high temperatures (280-350°C and 450°C) for the thermal degradation and charring of holocellulose, the release of volatile combustible gases, the risk of fire spreading, the need for forced extinguishing of flame combustion, and the difficulty of managing the process. Additionally, these methods can be harmful to the environment and human health, as they may release significant amounts of ammonia.

Technical solution

The invention's objective is accomplished through a method for obtaining black (carbon) decorative coatings by chemically charring the surface of wood, cellulose, or products based on them, which encompasses the following successive steps: *first*, surface plasma-chemical activation of the substrate, either directly via cold plasma treatment or indirectly (remotely); *second*, impregnation of the wooden substrate with aqueous solutions of phosphorus-containing flame retardants; *third*, drying the substrate to equilibrium humidity at room or elevated temperature, up to 180°C; and *fourth*, transforming the colourless coating into a black decorative coating by heating or scorching the surface of the substrate, in the temperature range of 225 to 275°C, resulting in the chemical charring of the wood due to the action of the separated (ortho)phosphoric acid. No prior use of phosphorus-containing flame retardants has been reported to obtain black (carbon) decorative coatings through surface chemical charring.

Application and advantages

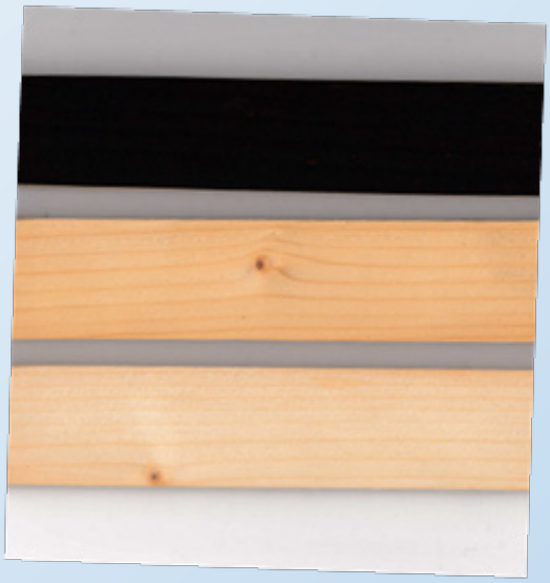
The method of obtaining black decorative coatings, through surface thermal carbonization, is applied industrially to produce black decorative coatings on products (boards, beams, plywood, paneling) from soft wood - pine, fir, cypress, Douglas fir, cedar and hardwood wood - magnolia, ash, elm, oak, teak, walnut. Most often, the method is applied to external wall (black) decorative cladding.

The black (charcoal) decorative coating is known to be resistant to mold, fungus and bacteria, insects, water and flame combustion. Carbon coating is a hard combustible coating that does not spread combustion.

The method is based exclusively on the use of phosphorus-containing flame retardants - organic and inorganic compounds of phosphorus (and nitrogen), for the formation of black decorative coatings on the surface of the wooden substrate, suppressing flame combustion and preventing the ignition of the wood and the spread of fire.

The colour of the coating, depending on the production conditions, can vary from brown, dark brown and black to bluish-black, but the effect of a uniform, continuous and saturated black decorative coating is sought, above all.

Technological images



5.1. Applied decorative (black) and protective (hard to ignite and hard to burn) carbon coating, for 15 minutes, at a temperature of 275 °C

5.2. Protective coating (flammable and flame retardant) based on phosphorus containing flame retardant, produced by surface impregnation (brush) and drying at room temperature.

5.3. White pine test body (*Pinus sylvestris L.*)

Contact for this offer

Ralitsa Zayakova-Krushkova, Ph.D.
Innovation manager
Technical University of Sofia (TU – Sofia)
Knowledge and Technology Transfer Center (KTTC)
Tel.: +359887 804 745
E-mail: rzayakova@tu-sofia.bg