

Non-combustible plywood – Is this possible?

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Abstract

In general, wood is classified in the building material class »normal flammability« according to DIN 4102-1 as well as according to DIN EN 13501-1. We have successfully developed a hybrid plywood, which is classified as »non-combustible«. This means that the wood-based material can be used in shipbuilding for cabin construction.

Within the scope of our development work, we and our project partners have developed a 12 to 50 mm thick plywood panel, which passes the non-combustibility test for shipbuilding (IMO FTP Code 2010 Part 1). The developed plywood panel consists of a multilayer plywood treated with a flame retardant using high-pressure impregnation, and a thin layer of foamed glass. To pass the non-combustibility tests, the test specimen is placed in a 750 °C hot oven for a defined time. The temperature development in the oven and the loss of mass are determined. This developed material increases the temperature in the non-combustibility furnace by approx. 30 K after 30 minutes with a mass loss of 24 to 35 %.

Parallel to the non-combustibility tests, the panels were subjected to a series of physical-mechanical tests. The quality of the bonding between the individual layers, but especially between the foamed glass and plywood layers, is of particular interest here. First of all, the tensile strength perpendicular to the plane of the panel was determined in accordance with EN 319. In the further project progress, additionally the compressive shear strength was determined according to EN 13354. With this method the quality of the bonding between the different layers can be investigated specifically.

With a bulk density of approximately 550 kg/m³, the plywood panel is as light as the conventional cabin wall material. Since only non-combustible materials may be used in shipbuilding, the interior of the ships is finished with inorganic materials such as alumina, calcium silicate and vermiculite. In our project we pursued the idea of adapting a renewable raw material such as wood to the requirements of fire protection by means of an innovative pretreatment. Due to its material properties, however, this plywood panel is much easier to process. Adjustments by sawing, drilling or milling can be carried out without problems during installation on site.

Not only in shipbuilding elevated requirements are made on fire protection, but also in building construction, which are described in the German Model Building Code (MBO). For highly fire-retardant (fire resistance of 60 min) or for fire-resistant (fire resistance of 90 min), the regulation requires generally non-combustible materials (§26 MBO). For materials developed by us, we were able to successfully prove their non-flammability according to DIN 4102-1. Currently we plan a test to classify these materials as non-combustible according to the European standard (DIN EN 13501-1). Since the material developed by us is an inhomogeneous material, the test cannot be carried out in a non-

combustible oven according to DIN EN ISO 1182, but is carried out by determining the heat of combustion according to DIN EN ISO 1716. After passing the test, the material can be used as a substitute for gypsum fiber or gypsum plasterboard in dry construction.

References

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