

SANDWICH BOARDS MADE FROM BIO-POLYURETHANE FOAM AND NATURAL FIBRE COVER LAYERS: NEW APPROACH FOR SUSTAINABLE LIGHTWEIGHT CONSTRUCTION

Holger Fischer, Nils Emde, Mansour Mirzaghavam

Faserinstitut Bremen e.V., Germany

fischer@faserinstitut.de, nils.emde@gmail.com, Mirzaghavam@Faserinstitut.de

Keywords: natural fibre, polyurethane, mechanical characteristics, bio-based composite, sandwich construction

Summary: Actually, large amounts of natural fibre reinforced fossil-based polyurethane (PU) are used e.g. in door trim panels or instrument boards in passenger cars. But in the area of lightweight construction, natural fibre reinforced plastics are poorly used in sectors like refrigerated vehicles, ship- and boat building, interior work, booth construction etc., although the standard materials used instead (MDF, plywood or chipboards) would be easily to replace by sandwich boards made of natural fibre-reinforced PU.

Consequently a sustainable sandwich construction was designed consisting of bio-based PU equipped with natural fibre semi-finished products as cover layers. This new approach enables the production of materials, which are lighter and less expensive than the currently used conventional materials.

This presentation reports the initial assessment of fibre-matrix interaction, the influence of different cover layer constructions (linen fabrics, felts, laid scrim etc.) and/or core reinforcement by hemp fleeces. Finally it was possible to produce the sandwich boards in a one-shot process. Using bio-PU PUR 900 and linen fabrics, it was possible to increase e.g. the flexural strength of sandwich boards from 11.12 ± 0.47 MPa to 30.80 ± 1.39 MPa, i.e. an increase of 176%. The flexural modulus increased from 385.6 ± 27.1 MPa to 1294.7 ± 58.5 MPa, i.e. by 235%. The densities of the new sandwich boards is in the range of 300 – 490 kg/m³, which is 40% to >50% less than chipboards or OSB boards. The flexural strength is approx. twice as much as that of chipboards and comparable to OSB boards, while the flexural modulus is approx. 50% of chipboards and 30% of OSB boards. In addition, the new sandwich materials come with a low and completely reversible water uptake.

Summing up, it was possible to generate a new sustainable lightweight construction material with outstanding properties, making them suitable for markets, where weight saving or improved insulation are requested. This is valid for vehicle construction in general (esp. refrigerated vehicles), ship- and boat building (interior work), but as well furniture industry or booth construction.