

# Composite deck structures for marine applications

Projektleiter: Dr. rer. silv. Wolfram Scheiding  
 Bearbeiter: Dr. rer. silv. Wolfram Scheiding,  
 Dipl.-Ing. (FH) Björn Weiß, Dipl.-Ing. Jens Gecks  
 Förderinstitution: EU / FP6 / STREP

Sub-project of EU research project „Developing lightweight modules for transport systems featuring efficient production and lifecycle benefits at structural and functional integrity using risk based design“ (DE-LIGHT Transport)

## Objectives

DE-LIGHT aimed to develop new solutions, methods and tools for design, production, integration and testing of complex modular lightweight structures in ships, intermodal transport containers and railway vehicles. Focus was given to the development of multimaterial modules with a higher degree of pre-outfitting, permanently considering issues of risk based design and life cycle costs. Results were demonstrated by large scale prototypes for six application cases.

## Material and Methods

IHD was involved due to its expertise for thermal wood modification. TMT was regarded as suitable substitute for tropical wood species, in particular Teak. Due to similar property profile, TMT Ash was chosen, modified at 180 °C and 200 °C (supplier: Mitteramskogler GmbH, Gaflenz/A).

Specific task of IHD was to determine different properties of the TMT:

- bending strength and modulus of elasticity
- tensile strength and modulus of elasticity
- shear strength of glue line
- reaction to moisture
- reaction to fire
- reaction to salt water exposure
- reaction to artificial and field weathering
- resistance to abrasion (castor chair test)
- thermal conductivity

## Results

The tests were carried out according to EN standards and specific regulations of shipbuilding and ship classification as well. Result were implemented in a material data base, to be used in the design tool, which was developed in DE-LIGHT to design and calculate lightweight sandwich structures from different materials and with different adhesives, fasteners etc. IHD performed tests on tensile strength (fig. 1) and mechanical load by a castor chair test (fig. 2).

At a demonstrator (mock-up), the TMT was bonded on the steel plates by area-wide gluing with special PU based adhesives (fig. 3). Bonding tests of TMT were performed by IFAM, Bremen.

For field weathering exposure tests, prefabricated specimens were used.

A real practice test was performed by installation of test areas on the cruise ship „AIDAbella“ built by Meyerwerft; TMT beech was used for a balcony deck (fig. 4) and a pool edge (fig. 5).



Fig. 1: TMT ash specimens after tensile test

In laboratory tests according to CEN/TS 15083-1, the biological durability of the TMT Ash treated at 200 °C was determined with class 1 (very durable) improved from durability class 5 (not durable). Gluing of TMT with the common adhesives used in marine applications (Sika products) worked well.

#### Summary

TMT Ash was proven as a possible substitute to Teak for cruise ship decks or balconies. Due to the reduced mechanical properties, the property level of Teak was approximated, but not fully reached. Further information and selected results are available at [www.delight-trans.net](http://www.delight-trans.net).



Fig. 2: Deck specimen of TMT ash after castor chair test



Fig. 4: Crew balcony deck covered with TMT beech



Fig. 3: Mock-up of a ship balcony with deck from TMT ash



Fig. 5: Pool edge made of TMT beech