Composite element with improved properties

Description

The present invention provides a composite element which is used in load-bearing constructions, based on two metal layers joined by polyurethane, and for the production and use thereof.

For the construction of ships, for example ships' hulls and load bay covers, bridges or high-rise buildings, it is necessary to use construction parts that can withstand considerable stresses by external forces.

Composite elements of this kind are described, for example, in property rights EP 0 938 410, EP 1 089 875, EP 1 094 938, EP 1 093 410, US 6,790,537, EP 1 240 010 and EP 1 315 761.

A problem encountered in the production of composite elements is that of achieving good, uniform and bubble-free filling of the air spaces between the two steel plates. Moreover, the surfaces of the plates have to be well wetted and sufficiently good adhesion between the plates and the polyurethane layer has to be established. Many polyurethanes have different expansion characteristics than the plates used, and so there can be detachment of the polyurethane from the plates in the event of variations in temperature. Moreover, the reaction products used for the production of the polyurethane have to be selected such that they do not contract so significantly in the course of curing as to result in detachment from the plates. At the same time, the construction parts of the invention must withstand high mechanical and dynamic stresses.

These problems can surprisingly be solved by a composite element according to main claim 1. The present disclosure therefore provides a composite element having the following layer structure:

(i) 2 mm to 20 mm of metal,
(ii) 10 mm to 100 mm of compact polyurethane formulation, the polyurethane being obtainable by reacting
(a) a compound having at least two isocyanate groups with
(b) polyether polyol,
optionally in the presence of
(c) catalyst and/or
(d) auxiliaries and/or additives,
(e) chain extenders
(iii) 2 mm to 20 mm of metal,

wherein the polyether polyol (b) is a mixture comprising at least the constituents of polyether polyol (b1) and polyether polyol (b2). Polyether polyol (b1) and polyether polyol (b2) are preferably not identical.

In an aspect, there is provided a composite element having the following layer structure:

(i) 2 mm to 20 mm of metal,

(ii) 10 mm to 100 mm of compact polyurethane formulation, said polyurethane formulation being obtainable by reacting

(a) a compound having at least two isocyanate groups with

(b) polyether polyol,

optionally in the presence of

(c) catalyst and/or

(d) auxiliaries and/or additives,

(e) chain extenders

(iii) 2 mm to 20 mm of metal,

where the compound a) comprising isocyanate groups has an NCO content of 20% to 50% and the polyether polyol (b) is a mixture comprising at least the constituents of polyether polyol (b1) and polyether polyol (b2),

wherein the polyether polyol (b1) has a number-average molecular weight between 3.0×10^3 g/mol and 7.0×10^3 g/mol, preferably between 4.0×10^3 g/mol and 6.0×10^3 g/mol,

the polyether polyol (b2) has a number-average molecular weight between 0.15×10^3 g/mol and 2.0×10^3 g/mol, further preferably between 0.15×10^3 g/mol and 1.0×10^3 g/mol, and especially preferably between 0.15×10^3 g/mol and 0.6×10^3 g/mol,

wherein the polyether polyol (b1) is present in the mixture at 50% by weight to 95% by weight, preferably at 55% by weight to 90% by weight and more preferably at 60% by weight to 85% by weight,

the polyether polyol (b2) is present in the mixture at 5% by weight to 50% by weight

In another aspect, there is provided a process for producing composite elements as defined above, which comprises mixing

(a) the compound comprising at least two isocyanate groups with

(b) polyether polyol, where the polyether polyol (b) is a mixture comprising at least the constituents of polyether polyol (b1) and polyether polyol (b2),

optionally in the presence of

(c) catalyst and/or

(d) auxiliaries and/or additives and/or

(e) chain extenders and allowing the mixture to cure in contact with the metal layers.

In another aspect, there is provided a composite element obtainable by a process as defined above.

In another aspect, there is provided the use of composite elements as defined above in vehicles, ships, aircraft or built structures.

In another aspect, there is provided a vehicle, ship, aircraft or built structure comprising composite elements as defined above.