

Description

The invention relates to a container with a lining consisting of GFK-laminate, and an intermediate layer of closed-cell foam material arranged between the lining and the container inner wall and glued to the latter.

Such container linings are generally manufactured from a chemically resistant material, for example a glass-fibre reinforced laminated plastic (GFK-laminate), in order to make a container consisting of concrete or steel suitable for receiving chemically aggressive substances.

With steel containers, a primer coat is usually applied to the metallicly untarnished steel surface, which has been previously prepared by sandblasting. With concrete containers, the surface of the concrete must be dry, oil- and dust-free, and must have satisfactory tensile strength. To the previously prepared surface is applied a plastic filler mixture, to which is then applied the GFK-laminate forming a laminar cohesion. The uppermost layer of the GFK-laminate can be constructed as a seal having an especially firm and chemically resistant surface.

Particular difficulties are encountered when attaching a lining to old containers, the inner wall of which in the case of concrete containers often no longer possesses the required tensile strength or even has cracks. In the case of steel containers, there may be for example an old rubber coating, the removal of which would involve considerable effort. Since, in the case of concrete containers or brick-lined containers, so much material would have to be removed from the container inner wall in order to attain a sufficiently solid and crack-free base, that not only is considerable effort required; in most cases, the resulting surface is very uneven and a great deal of material is required to level it.

On a rough base, as exists for example even with new concrete containers, the intermediate layer must be at least thick enough to level out all protruding roughness of the base. In the case of a known container (US-A-3 738 527), the intermediate layer consists of a comparatively thick coating of closed-cell foam material which is glued firmly to the container. The lining is firmly glued to the intermediate layer. Because of the firm union of the lining with the intermediate layer and with the inner wall of the container, cracks arising in the container wall lead to stress on the intermediate layer and the lining, which can even cause cracks to form in the lining.

Accordingly, it is an object of the invention to develop a container of the kind mentioned initially, so that stress on or damage to the lining is excluded even if cracks or the like appear in the container wall.

This problem is solved according to the invention in that the lining is only joined to the container at the top rim thereof, the lining is joined directly to at least one attachment intermediate layer fixed to the container inner wall, and the lining in the other zones hangs loosely and in a self-supporting manner in the container.

Since the lining is only joined directly to the container at the top container rim and is joined to at least one attachment intermediate layer, and in the other zones hangs loosely and in a selfsupporting manner in the container, there is no fear of damage to the lining, even if cracks should appear in the container wall. Since the lining consists of GFK-laminate, it has sufficient strength to be of selfsupporting construction even in the case of large containers. Adhesion to the intermediate layer in order to attain the required strength of the lining is not necessary. The transfer of forces between the container inner wall and the lining is substantially eliminated. Therefore, neither can tensile stresses exerted by the lining on the

container inner wall lead to separation at the container inner wall, nor can cracks and other damage have a harmful effect on the lining, even if the cracks should subsequently effect movement. Unevenness of the container inner wall does not penetrate the soft elastic intermediate layer, and cannot therefore lead to damage of the lining. Loose parts of the container inner wall, or parts which are otherwise unsuitable for joining to a lining, for example remains of old linings, do not have to be removed, which considerably reduces the requirements necessary for preparation of the container inner wall.

A container is indeed known (US-A-3 135 420), in which the container lining is joined to the top container rim. In this case, the lining has ribs on its side facing the container inner wall. Thus, channels are produced between the lining and the container inner wall, through which a gas may pass in order to remove materials which diffuse through the lining. The lining is hereby supported directly against the container wall by means of the attached ribs. There is however no provision here for an intermediate layer of foam material or the like.

In the case of containers which have essentially symmetrical rotation, the attachment intermediate layers may be rings or ring segments, which may be pegged or attached in another way to the container inner wall. The attachment intermediate layers may consist of steel or GFK. On its inner side, the lining which consists of GFK-laminate is secured by adhesion.

In the following, the invention is illustrated more fully by the examples of construction demonstrated in the drawings. In these:

Fig. 1 shows a container with a lining in a vertical part section,

Fig. 2 shows a modified embodiment of the attachment of the lining to the top container rim in a vertical part section,

Fig. 3 similarly in a vertical part section shows a further

embodiment of the attachment of the lining to the container and Fig. 4 in a part section shows another embodiment of the container lining.

In the examples of construction as illustrated, a standing cylindrical container 1 consists of concrete. The container interior is provided with a lining 2 consisting of a GFK-laminate, which is for example a roving laminate, a mat laminate or a sprayed fibre laminate, the glass-fibre inserts of which give the lining sufficient tensile strength for it to be at least to some extent self-supporting. Around the upper rim of the container 1, the lining 2, after appropriate preparation, is firmly bonded to the container surface. In the remaining regions, polyethylene foam panels 4 are placed between the lining 2 and the container inner wall 3, and these panels are joined to the container inner wall 3 by adhesion point-by-point so as to hold the inserted foam panels 4 in place during assembly.

At vertical intervals and on the upper container rim, steel rings 5, which may also consist of individual ring segments 5', are fixed to the wall of the container 1 by means of dowels 6 and dowel screws 7. The lining 2 is attached by adhesion to the surface of the rings 5 or ring segments 5'. In the intermediate regions, the lining 2 lies only loosely against the foam panels 4 and supports itself. The distance between the rings 5 resp. ring segments 5' is chosen so as to avoid buckling of the lining 2.

Instead of the rings 5 or ring segments 5', or in addition thereto, vertical struts 5a are provided at intervals. In the construction example illustrated, these struts similarly consist of steel and are fixed in the described manner to the container inner wall 3 and the lining 2.

At the bottom edge of the container, a rounded corner 8 can be provided by a coating of putty 9.

In order to receive the lining 2, the container inner wall 3 does not have any prior preparation; it can sustain unevenness, old unsound brickwork, more or less loose surface particles or remains of an old surface coating. The container 1 itself may have cracks or slits. The foam panels 4 form a buffer layer, which prevents any disadvantageous disruption to the lining 2 by the container 1 and especially its nature of surface.

The struts 5a, rings 5 resp. ring segments 5' hereby form the attachment surface regions, on which is supported the lining 2 which is suspended in the container 1 as a shell.

A modified type of attachment of the lining 2 to the upper rim of the container 1 is shown in Fig. 2. Here, a steel ring 5 is pegged into the upper container rim on the container inner wall 3 and is joined to the upper edge of the lining 2 by adhesion. This type of attachment is offered especially when the container has a (not illustrated) cover which cannot be removed, so that the upper side of the container rim is not accessible for application of the lining 2.

The struts 5a, rings 5, ring segments 5' or similar attachment intermediate layers may also consist for example of GFK and may be glued or similarly pegged to the container 1.

A further modified embodiment is shown in Fig. 3. Here, the GFK-lining 2 is glued to vertically arranged or circular strips 5'' consisting of a synthetic resin concrete, which are mounted in grooves 16 chiselled out of the wall of the container 1. As in the embodiments of figs. 1 and 2, foam panels 4 are located between the strips 5'', and the lining 2 is loosely attached to the surface of these panels.

A further modified embodiment is shown in Fig. 4. Here, the GFK-lining 2 is reinforced by internal GFK-ribs 2a, which serve at the same time as vortex breakers in stirrer-equipped containers.

The ribs 2a increase the strength of the lining 2, so that additional attachment intermediate layers such as the rings 5 or the like do not have to be provided, or only at relatively large intervals.

Instead of the described construction of the concrete container 1, the container 1 may also consist for example of steel. At the inner wall 3 of this container is supported a rubber reinforcement or another coating or remains thereof, which must not be removed at least in the area of the foam panels 4, so as to attach the lining 2.

Instead of the described foam material for the panels 4, another soft elastic material can also be used, for example flat pieces of thermoplastic material.



claims

1. Container with a lining consisting of glass-fibre reinforced laminated plastic (2) (GFK-laminate) and an intermediate layer (4) made from closed-cell foam material arranged between the lining (2) and the container inner wall (3) and glued to the latter, characterised by the fact that the lining (2) is only at the top container rim directly joined to the latter, that the lining (2) is directly joined to at least one attachment intermediate layer (5, 5a, 5', 5'') fixed to the container inner wall (3) and that the lining (2) in the other zones hangs loosely and in a selfsupporting manner in the container (1).
2. Container according to claim 1, characterised by the fact that the attachment intermediate layers in the case of containers essentially symmetrical in respect of rotation (1) are rings (5, 5'') or ring segments (5').
3. Container according to claim 1 or 2, characterised by the fact that the attachment intermediate layers (5, 5a, 5') are pegged to the container inner wall (3).
4. Container according to claim 1 or 2, characterised by the fact that the attachment intermediate layers (5, 5a, 5') consist of steel.
5. Container according to claim 1 or 2, characterised by the fact that the attachment intermediate layers (5, 5a, 5') consist of glass-fibre reinforced plastic (GFK).