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(54) **Title:** A Process For Manufacturing A Tank Or Container By Using A Polymer Concrete Mixture

(57) **Abstract:** A process for manufacturing a corrosion resistant tank or container comprises the steps of mixing a filler material consisting of a corrosion resistant aggregate with a corrosion resistant resin binder and a polypropylene based fibre material to form a polymer concrete mixture and, introducing this mixture into a mould and allowing it to cure, the mould being optionally vibrated to produce a homogenous casting. The corrosion resistant tank or container is preferably a corrosion resistant electrolytic cell used in the electrolylic treatment of metals and salts.

(56) **Documents Cited:** EP - 0699 7116; EP 0648303; WO 9719135

BACKGROUND OF THE INVENTION

THIS invention relates to the manufacture of tanks or containers, and in particular to the manufacture of corrosion resistant tanks or containers.

Corrosion resistant containers in the form of acid resistant electrolytic cells are used for the electrolytic treatment of metals and salts. The basic method employed for the recovery of metals is to dissolve the metal in an acid solution. This solution is passed through a series of electrolytic cells (tanks). The cells are fitted with negatively and positively charged anodes and cathodes. Through a process of electrolysis the metal in the acid solution is deposited on the cathode leaving behind all other metals as a sludge. The pure metal adhering to the cathodes is stripped from the cathodes at regular intervals.

The acid solution employed in metal recovery is highly corrosive. In order to protect the cell or tank structure from corrosive damage, the interior walls and base are covered with a corrosion resistant material such as lead sheets, plastics or rubber liners or other protective systems, for example.

A disadvantage of coating the surfaces which are exposed to the corrosive medium is that they can be damaged by mechanical action. This damage usually occurs when the metal laden cathodes are removed for stripping. The cathodes often dislodge from the lifting mechanism, fall into the cell or tank and puncture or severely damage the protective lining or coating.

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The repairs to this damage can only be undertaken periodically and thus the cell structure is subject to corrosive action by the leaking cell contents. This action weakens the cell and creates a potentially dangerous situation after a period of time.

In order to avoid the inherent danger described above and also to create an efficient electrolytic process the structure of electrolytic cells and tanks have undergone changes.

The basis of the changes have been to select corrosion resistant aggregates, which are carefully graded and batched into suitable mixtures of matched granule distribution. This mixed aggregate is then mixed with a highly corrosion resistant vinyl ester or similar resin to form a polymeric concrete. When catalysed and introduced into prepared moulds this mixture, when cured, provides an extremely robust and corrosion resistant structure.

There are a number of methods of cell manufacture. One such method is to prepare a polymeric concrete mixture and introduce this mixture into a prepared mould in a minimum period of time. This mould is vibrated during filling in order to improve the integrity of the casting by consolidating the wet mixture and also to remove air bubbles from the mixture. This method of producing a cell or tank results in an integrally cast unit with no jointing required at a later stage.

A major problem which is encountered when using this system of casting cells or tanks is cracking of the casting as a result of the thermal forces generated during catalysation of the resin binder.

SUMMARY OF THE INVENTION

According to the invention there is provided a process for manufacturing a corrosion resistant tank or container comprising the steps of:

(a) mixing a filler material consisting of a corrosion resistant aggregate with a corrosion resistant resin binder and a polypropylene based fibre material to form a polymer concrete mixture; and

(b) introducing the mixture of step (a) into a mould and allowing it to cure, the mould being optionally vibrated to produce a homogenous casting.

The corrosion resistant tank or container is preferably a corrosion resistant electrolytic cell used in the electrolylic treatment of metals and salts.

In step (a), the fibre material can be added to a pre-mixture of filler material and resin binder.

Alternatively, the fibre material and filler material can be pre-mixed, prior to being mixed with the resin binder.

The fibre material preferably comprises halogenated polypropylene fibres, in particular fluorinated polypropylene fibres.

The fibres are preferably about 20 to about 30mm in length, typically chopped or cut from strands of the fibre material.

The fibre material is preferably added to the polymer concrete mixture in an amount of about 1,35 to about 2,3 kilograms of fibre material per cubic metre of casting volume.

The resin binder is preferably catalysed to assist the curing stage.

The polymer concrete mixture in step (a) preferably comprises about 9% to 15% by mass catalysed resin binder and about 85% to 91% by mass of filler material, based on the combined mass of resin binder and filler material.

Conventional additives can be added to the polymer concrete to assist the curing process, including promoting agents, accelerators, and wetting and dispersing agents. In particular, it has been found to be particularly advantageous to add a wetting agent to the resin, based on the mass of fines in the aggregate batch material. The wetting agent is preferably added in an amount of 0,75 % to 2 % by mass of the fines present in the mixture.

The corrosion resistant aggregate material is preferably a silica quartz material.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

The present invention involves the addition of a polypropylene based fibre material and suitable wetting agent to a polymer concrete mix to be used in the manufacture of corrosion resistant tanks or containers, particularly electrolytic cells used in the electrolytic treatment of metals and salts.

The polymer concrete material is produced by mixing a corrosion resistant

aggregate filler material with a suitable resin binder. The aggregate material is preferably a top grade silica quartz material. Available materials permitting, the silica aggregate is batched as follows in order to provide a homogenous casting:

Silica flour 150 Mesh	10%
0,075 to 0,3mm diameter sand	10%
0,3 to 0,8mm diameter sand	10%
0,8 to 2,4mm diameter sand	30%
2,4 to 5,0mm diameter sand	40%

The chosen resin binder is a vinyl ester type resin with the following properties:

a) Viscosity	300 to 450 cst (3×10^{-4} to $4,5 \times 10^{-4}$ m^2/s)
b) Styrene Content	25 to 35%
c) Tensile elongation	5 to 7%
d) Flexural Modulus	3 to 3,5 Gpa

As the curing process is a catalysed process, a suitable catalyst is added to the binder resin. Although any suitable catalyst system can be used, a preferred system is a methyl ethyl ketone peroxide type LA3 catalyst. The catalyst is added to the resin in an amount of about 1,25 to about 1,75% of catalyst per mass of resin.

The resin binder should be promoted and accelerated according to the resin manufacturer's specifications. Standard cobalt octoate and dimethylaniline (DMA) are used for acceleration and promotion purposes.

In addition, a wetting and disbursing agent such as BYK-W966, produced by Byk Chemie of Germany, for example, is added to the resin, depending on the mass of fines in the aggregate batch material. The wetting agent is added in an amount of 0,75% to 2% by mass of fines present in the mixture. By "fines" is meant that portion of the silica aggregate consisting essentially of silica flour 150 mesh and 0,075 to 0,3mm diameter sand.

The batch mixing of the polymer concrete can be carried out in a custom built or conventional mechanical mixer. The polymer concrete is mixed in the following proportions:

Catalysed resin content by mass	9% to 15%
Filler content by mass	85% to 91%.

The fibre material, in the form of flourinated polypropylene fibres, can either be added to the pre-mixed polymer concrete mixture or, if desired, it can be added to the silica aggregate prior to mixing with the resin binder.

Although flourinated polypropylene fibres are preferred, any other suitable polypropylene fibre material, particularly halogenated polypropylene fibres, can be used. The fibres are cut or chopped from strands of the fibre material into lengths of about 20 mm to about 30 mm.

The mixture of resin binder, silica aggregate and fibre material is mixed thoroughly prior to being introduced into the casting mould. The mould can be vibrated to ensure a homogeneous casting. Once the mould is filled to the desired level, a final vibrating cycle is maintained until visible quantities of resin rise to the upper surface of the casting. The vibration is then stopped and the concrete is allowed to gel and set.

When the exposed surface of the casting has set and is hard to the touch, the mould is manipulated in such a manner as to enable partial removal of the inner core. Timely removal of the inner core allows shrinkage of the casting to take

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place without any detrimental effect to the actual casting. The complete mould can be dismantled after approximately 6 hours. The casting is removed from the mould and the mould can then be prepared for a new casting.

If desirable, mild steel, stainless steel or non-metallic reinforcing bars can be incorporated into the casting to add additional strength and rigidity.

It is believed that the major advantage of the present invention over conventional processes for producing corrosion resistant tanks or containers is that the addition of the fluorinated polypropylene fibres assists in the combating of cracking caused by the thermal forces generated during catalysation of the resin binder. In addition, the addition of the fluorinated polypropylene fibres limits crack propagation in the polymer concrete walls of the container or tank once cast. The addition of a suitable wetting agent is believed to enhance these advantages.

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CLAIMS

1. A process for manufacturing a corrosion resistant tank or container comprising the steps of:

   (a) mixing a filler material consisting of a corrosion resistant aggregate with a corrosion resistant resin binder and a polypropylene based fibre material to form a polymer concrete mixture; and

   (b) introducing the mixture of step (a) into a mould and allowing it to cure, the mould being optionally vibrated to produce a homogenous casting.

2. A process according to claim 1, wherein the corrosion resistant tank or container is a corrosion resistant electrolytic cell used in the electrolylic treatment of metals and salts.

3. A process according to claim 1 or claim 2, wherein in step (a), the fibre material is added to a pre-mixture of filler material and resin binder.

4. A process according to claim 1 or claim 2, wherein the fibre material and filler material are pre-mixed, prior to being mixed with the resin binder.

5. A process according to any preceding claim, wherein the fibre material comprises halogenated polypropylene fibres.

6. A process according to claim 5, wherein the halogenated polypropylene

fibres are fluorinated polypropylene fibres.

7. A process according to any preceding claim, wherein the fibres are about 20 to about 30mm in length.

8. A process according to claim 7, wherein the fibres are chopped or cut from strands of the fibre material.

9. A process according to any one of the preceding claims, wherein the fibre material is added to the polymer concrete mixture in an amount of about 1,35 to about 2,3 kilograms of fibre material per cubic metre of casting volume.

10. A process according to any one of the preceding claims, wherein the resin binder is catalysed to assist the curing stage.

11. A process according to any one of the preceding claims, wherein the polymer concrete mixture in step (a) comprises about 9% to 15% by mass catalysed resin binder and about 85% to 91% by mass of filler material, based on the combined mass of resin binder and filler material.

12. A process according to any one of the preceding claims, wherein a wetting agent is added to the resin, based on the mass of fines in the aggregate batch material.

13. A process according to claim 12, wherein the wetting agent is added in an amount of 0,75% to 2% by mass of the fines present in the mixture.

14. A process according to any one of the preceding claims, wherein the corrosion resistant aggregate material is a silica quartz material.

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