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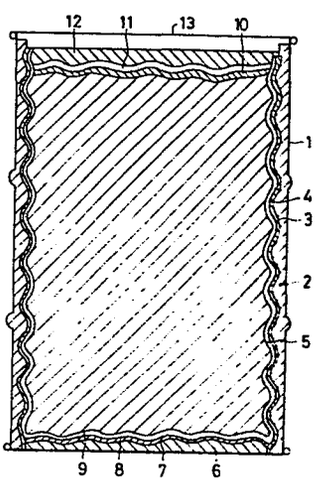
(54) **Solidified product of radioactive waste for disposal thereof.**

(57) A thin film of a solidifying material (2) such as an alkali silicate is formed on the inner surface of a container (1), and glass fiber (3) is laid over said film of solidifying material so that the glass fiber is partly embedded into the surface of the layer (2) of solidifying material. The surface (4) of the glass fiber layer is roughened and a water-impervious material (5) is attached to the roughened glass fiber surface (4) to form a water-impervious layer. A solidifying material and radioactive waste are packed in the thus formed container and solidified, thereby forming a radioactive waste-encapsulating solidified block having a water-impervious layer.

FIGURE



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SPECIFICATION

TITLE OF THE INVENTION:

SOLIDIFIED PRODUCT OF RADIOACTIVE WASTE FOR DISPOSAL THEREOF

BACKGROUND OF THE INVENTION:

This invention relates to a solidified product for the disposal of radioactive wastes produced at nuclear power plants, etc., and more particularly it relates to a solidified product of radioactive waste for disposal incorporating an improvement to the conventional solidified coating of a mass of radioactive waste packed in a container.

Heretofore, radioactive waste has been encapsulated in a solidifying material such as cement, plastic, asphalt, etc., and is then placed in a drum to form a solidified product of radioactive waste for the disposal thereof. This encapsulated product, because of its nature, tends to become porous when solidified, so that, in view of this water perviousness, it is inevitable that the ratio of waste being treated to the solidifying covering material is limited when forming this product. This cannot meet the demands of volume reduction in the disposal of a large quantity of radioactive waste such as that produced at a nuclear power plant.

SUMMARY OF THE INVENTION:

The present invention has the object of providing a solidified product of radioactive waste for the disposal thereof, by which the volume of radioactive waste that can be treated when forming a solidified mass confined in a container can be increased by an inexpensive means.

According to the present invention, in order to accomplish the above object, the radioactive waste being treated is first coated with a layer of an inorganic or organic material which is solidified, the surface of this solidified layer is then covered with a water-impervious layer, and the thus coated mass of radioactive waste is placed in a sealed container. Thus the present invention is characterized by the formation of a water-impervious layer on the surface of a solidified layer to ensure a complete prevention of the leakage of radioactive material due to the penetration of water while allowing a substantial reduction in the thickness of the coating layer itself.

Among the available solidifying agents for encapsulating radioactive waste, plastic is the most desirable from the aspect of volume reduction, but cement is highly valued from the safety viewpoint

based on the results of practical use in many fields.

The present invention also makes it possible to use even an inorganic material such as an alkali silicate solution as the solidifying agent which is more stable and has higher volume-reducing ability than the above conventional materials, while avoiding an increase of the thickness of the coating due to the porous property of the material to allow a highly efficient and compact packing of the waste material.

BRIEF DESCRIPTION OF THE DRAWING:

The drawing is a schematic sectional view of a complete solidified product of radioactive waste for the disposal thereof according to an embodiment of this invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT:

The present invention will now be described by way of an embodiment thereof while referring to the accompanying drawing.

A container 1, which is open at one end, is set upright with its open end facing upwards, and an alkali silicate solution is poured thereinto as a solidifying agent while said container 1 is rotated about its vertical axis. As the container 1 rotates, the solidifying agent adheres in the form of a thin film to the inner surface of the container 1 by

virtue of centrifugal force to form a layer 2. The layer 2 can maintain this thin film-like state for a certain period of time because of the viscosity of the solidifying agent. A layer of glass fiber 3 impregnated with the alkali silicate solution is laid on the surface of the film-like layer of solidifying agent 2 before the solidifying agent sets completely. The container 1 is rotated about its vertical axis with the glass fiber 3 adhering to the surface of said layer 2. Because of this rotation, the solidifying agent impregnating the glass fiber 3 and the layer of solidifying agent 2 adhering in the form of a thin film to the inner surface of the container 1 are combined into a single layer of solidifying agent. The glass fiber is embedded in this layer and the solidifying agent sufficiently penetrates between the individual fibers. The solidifying agent is dried so as to set under these conditions. The solidifying agent flows gravitationally down the inner surface of the glass fiber layer 3 and, as a result, a rough surface 4 is created on the inner surface of this glass fiber layer 3. A water-impervious layer 5 is then formed on this rough surface 4 of the glass fiber layer 3 as described below.

Then the alkali silicate solution acting as the

Solidifying agent is spread over the bottom of the container 1 to form a thin layer 6 in a manner similar to the layer formed over the innder surface of the container described above, and a layer of glass fiber 7 is laid on the surface of said layer 6 before it sets completely. This glass fiber layer 7 is impregnated with the alkali silicate solution and the latter is dried and solidified in the same way as the inner surface of the container 1 described above. The alkali silicate solution impregnating the glass fiber 7 may be that which has flowed down the inner surface of the container 1, or it may be separately supplied from the outside. Any superfluous alkali silicate solution impregnating the glass fiber layer 7 is removed from the container 1, and a rough surface 8 is created on the surface of said glass fiber layer 7 in the same manner as that on the inner surface of the container 1 described above.

Water-impervious layers 5, 9 are formed over said rough surfaces 4, 8 of the respective glass fiber layers 3, 7 in the following way. The container 1 is sealed and evacuated to create a negative pressure therein, and then the water-impervious material is poured into this evacuated container 1, whereby the

inter-fiber spaces in the glass fiber layers 3, 7 covering the inner surface of the container 1 are also placed under a negative pressure, allowing said water-impervious material to fill up even the most minute spaces between the individual fibers. An inorganic ceramic material, for example a glaze having the composition of 61% SiO_2, 14% B_2O_3, 10% Al_2O_3, 8% NO_2O and 7% K_2O, is preferred as the water-impervious material used in this invention. This water-impervious material is applied over the rough surfaces 4, 8 of said glass fiber layers 3, 7 so that it penetrates into said layers 3, 7. The whole assembly is fired at a temperature of 900° to 1,300°C to thereby form a solidified container having water-impervious layers 5, 9.

Compression molded pellets of radioactive waste are packed into this solidified container, and then the alkali silicate solution is poused therein so that all of the pellets are coated with the solution, and then glass fiber 10 is placed on the top of the waste. This glass fiber 10 is then impregnated with the alkali silicate solution, solidified and fired to form the same water-impervious layer 11 as those on the sides and bottom of the container. A layer 12 of the alkali silicate solution alone is then provided on said

water-impervious layer 11 and finally the container is sealed by a cover 13.

According to this method of forming a solidified product of radioactive waste, the glass fiber adhere fast to the inner surface of the container 1 because of the alkali silicate solution, while the water-impervious layers 5, 9, 11 also adhere securely to the roughened surfaces of the glass fiber layers 3, 7, 10 through the medium of the alkali silicate solution, so that a solidified coating with a high resistance to water from the outside of the container is obtained. Therefore, even if the solidified coating is relatively reduced in thickness, a sufficient water resistance is still provided, and thus it is possible to increase the amount of waste that can be packed into the solidified coating, compared with the conventional practice in which the waste is covered with a solidified coating alone. This device can thus realize a highly efficient disposal of radioactive waste.

When using a glaze having a composition such as that given above for the formation of the water-impervious layer, a particularly good workability is provided owing to the low fusing point of such a glaze, but it is also possible with this invention to use

other materials having a good adhesion to both the container and the solidified layer, for example a polymerizable monomer such as unsaturated polyester, methyl methacrylate, styrene resin and other water-resistant resins (including water-resistant paints) as well as ceramics.

Use of glass fiber as a solidifying agent-absorbing layer as in the above embodiment provides the advantage that a solidified coating with a perfect water imperviousness can be obtained with maximal workability while retaining the economic advantage.

In the foregoing embodiment, the waste is packed in the form of pellets, but in this invention, the waste need not necessarily be formed into pallets, it could be powdered, mixed with an alkali silicate and then solidified in a manner similar to the above. This procedure can also provide a solidified product with high water resistance.

It will be obvious that both organic and inorganic materials can be used for forming the solidified coating in this invention.

As described above, it is possible with this invention to obtain a water-resistant and economically advantageous solidified product of radioactive waste for disposal even when using a porous solidifying

agent such as an alkali silicate solution for which a good applicability has been proved in practice, by forming a water-impervious layer over the inside of the container. This makes it possible to pack more radioactive waste into a solidified coating, in other words, the amount of radioactive waste that can be contained in a solidified product is appreciably increased. This also leads to a reduction of the space required for the storage or disposal of radioactive waste.

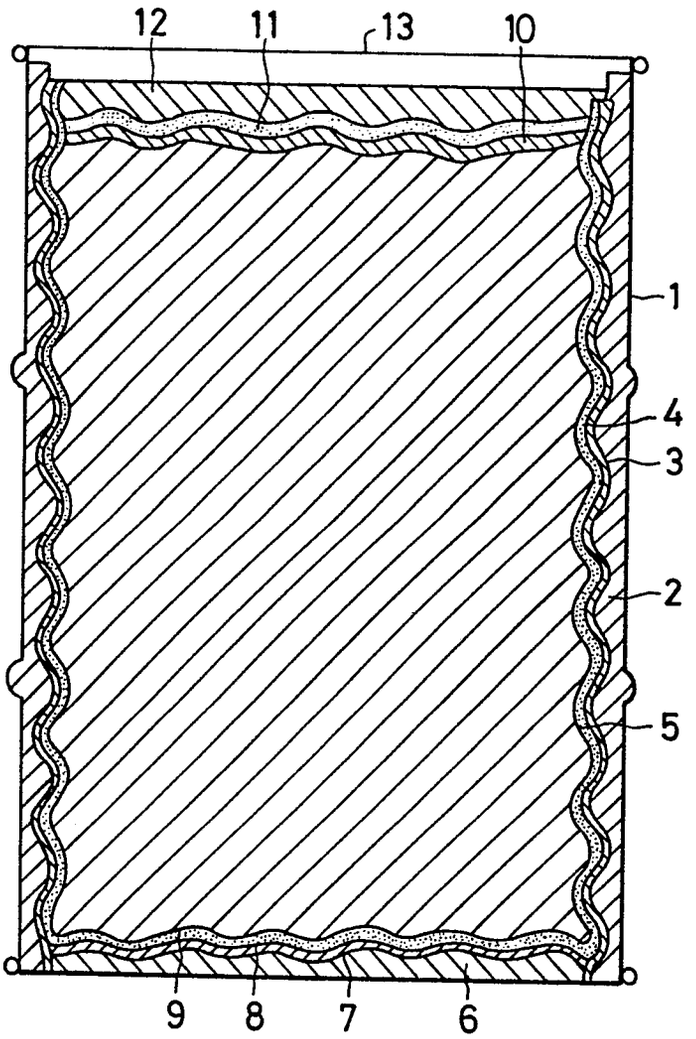
WHAT IS CLAIMED IS:

1. A solidified product of radioactive waste for disposal, which product is formed by covering the external surface of a mass of radioactive waste with a solidified layer composed of an inorganic or organic material and placing the thus covered mass of radioactive waste in a sealed container, characterized in that a water-impervious layer (5, 9) is provided on the surface of said solidified layer (2, 6, 12).

2. The solidified product of radioactive waste for disposal according to Claim 1, wherein said water-impervious layer (5, 9) is composed of a water-resistant resin, glaze, or a ceramic material.

3. The solidified product of radioactive waste for disposal according to Claim 1, wherein a layer (3) of glass fiber is provided extending over and also sandwiched between both said water-impervious layer (5, 9) and said solidified layer (2, 6, 12).

FIGURE



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EUROPEAN SEARCH REPORT

0082483
Application number

EP 82 11 1669

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X,Y	FR-A-2 356 246 (GESELLSCHAFT FUR KERNFORSCHUNG) *Claims 1,4,5*	1,2,3	G 21 F 9/36
Y	FR-A-2 473 213 (ECOPO) *Claims 1,5,8*	1,2	
A	DE-B-1 173 998 (FRIESE) *Claim 1*	1	
A	DE-A-2 549 304 (AEROJET)		

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

G 21 F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12-04-1983	NICOLAS H.J.F.

CATEGORY OF CITED DOCUMENTS

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