A cathode for electrowinning zinc is formed by an aluminum plate having broad flat faces and at least one narrow edge bridging the faces and a polyolefin copolymer strip bonded to the plate over the edge thereof. The polyolefin copolymer strip can include an inner layer directly bonded to the aluminum plate and formed of the bonding polyolefin copolymer and an outer layer of standard polyolefin.
Abstract of the Disclosure

A cathode for electrowinning zinc is formed by an aluminum plate having broad flat faces and at least one narrow edge bridging the faces and a polyolefin copolymer strip bonded to the plate over the edge thereof. The polyolefin copolymer strip can include an inner layer directly bonded to the aluminum plate and formed of the bonding polyolefin copolymer and an outer layer of standard polyolefin.
ALUMINUM CATHODE FOR ELECTROWINNING ZINC

SPECIFICATION

Field of the Invention

The present invention relates to the electrowinning of zinc. More particularly this invention concerns an aluminum cathode for zinc electrowinning.

Background of the Invention

In the electrowinning of zinc, plate cathodes of aluminum are alternated with plate anodes of lead in a bath of zinc calcine (ZnO) in sulfuric acid (H₂SO₄). Voltage is applied across the electrodes and the zinc plates out on the aluminum cathodes while oxygen is generated at the lead anodes. In this manner it is possible to produce high-purity metallic zinc from the zinc-sulfate solution.

While deposition of the zinc on the faces of the cathode is of course desirable, the edges of the cathode are normally masked in order to prevent buildup at these regions of higher current density as such buildup could bring the zinc into contacts with the walls of the cells or with the anodes. In the standard systems, edge strips of wood, rubber, or plastic are used as described in German patent application 3,219,300, published November 24, 1983.

The main problem in such systems is that the sulfuric acid of the extraction bath gets under the edge strips and corrodes the aluminum cathode. As a result the edge strip can come loose, zinc can rapidly build up on the cathode edge, and the system can short out to the anode or the wall of the cell.
Objects of the Invention

It is therefore an object of the present invention to provide an improved cathode for electrowinning zinc.

Another object is the provision of such an improved cathode for electrowinning zinc which overcomes the above-given disadvantages, that is whose edges are protected against premature failure.

Yet another object is to provide an improved method of making such an electrode.

Summary of the Invention

A cathode for electrowinning zinc according to this invention is formed by an aluminum plate having broad flat faces and at least one narrow edge bridging the faces and a polyolefin copolymer strip bonded to the plate over the edge thereof. This combination of materials -- polyolefin copolymer and aluminum -- makes it possible to form a very tight bond between the insulating edge strip and the conductive aluminum plate so that no acid can get between the two and erode the plate.

According to another feature of this invention the polyolefin copolymer strip comprises an inner layer directly bonded to the aluminum plate and formed of the bonding polyolefin copolymer and an outer layer of standard polyolefin. It is also within the scope of this invention to make the entire strip of the high-bonding polyolefin copolymer.

The cathode according to this invention is made by heating a bonding polyolefin copolymer and extruding it as a strip and then applying this strip while still hot from extrusion to the edge of an aluminum plate. The strip is applied at a temperature of between 100°C and 200°C, preferably between 160°C and 180°C, for 1min to 5min. The strip can be applied to both longitudinal edges of a longitudinally extending aluminum band and this band can subsequently be cut into
the individual plates. It is also possible according to the method of this invention to coextrude high-bonding (that is polyolefin-copolymer) and standard polyolefins as the strip and apply them to the plate edge with the high-bonding polyolefin copolymer in direct contact with the plate edge.

It is also possible to make the cathode according to this invention by applying an inner layer of a high-bonding polyolefin copolymer directly to the edge of an aluminum plate and then fitting a strip of normal polyolefin over the layer of high-bonding polyolefin copolymer on the plate edge.

According to the invention the polyolefin copolymers are mixed polymers of olefin and bonding additives for metallic surfaces. These additives are as a rule aliphatic carboxylic acids in a ration of 1% to 10% by weight, for example acrylic acids or their derivatives. Instead of acrylic acid esters can be employed, for example vinyl acetate. Vinyl acetate can also be used simultaneously with acrylic acids and even other terpolymers can be used. The invention can also employ melt-type glues of a polyolefin base so long as they are sufficiently corrosion resistant.

**Brief Description of the Drawing**

The above and other objects, features, and advantages will become more readily apparent from the following, reference being made to the accompanying drawing in which:

Fig. 1 is a small-scale largely diagrammatic view in vertical cross section illustrating a zinc electrowinning cell equipped with the cathode of this invention;

Fig. 2 is a large-scale horizontal section through a detail of the cathode of Fig. 1; and

Fig. 3 is a view like Fig. 2 of another cathode according to the invention.
Specific Description

As seen in Figs. 1 and 2 a zinc electrowinning cell 3 contains a bath 2 of a zinc-sulfate solution and an aluminum cathode plate 1 suspended from a hanger 5 riding on electrical feeds 4 and 4'. This cathode 1 has vertical edges provided with polyolefin copolymer insulating strips 6 which, as shown in Fig. 2, are U-shaped in section so as not only to cover edges 1' of the plate 1, but to reach over slightly to faces 1" thereof.

Fig. 3 shows an alternative arrangement where an edge strip 6' is formed of an inner U-shaped bonding layer 7 and a U-section outer strip 8. The inner layer 7 is of a bonding polyolefin copolymer.

The system of Fig. 3 is made by extruding two such inner layers 7 and applying them while still hot from the extrusion to opposite edges of an aluminum band. This band is then cut into individual plates and the outer layers 8 are fitted to them to serve as hangers for the cathode plates thus produced.
WHAT IS CLAIMED IS:

1. A cathode for electrowinning zinc, the cathode comprising:

   an aluminum plate (1) having broad flat faces and a narrow edge bridging the faces; and

   a strip of polyolefin copolymer (6), consisting of a polymer of olefin and 1-10% by weight of adhesive additives of aliphatic carbonic acids or derivatives thereof, directly bonded to and surrounding the narrow edge of the aluminum plate (1).

2. A cathode as claimed in Claim 1, wherein the polyolefin copolymer strip (6) includes an inner layer (7) directly bonded to the aluminum plate (1) and formed of a bonding polyolefin copolymer and an outer layer (8) of polyolefin.

3. A cathode as claimed in either of Claims 1 or 2 where the polyolefin copolymer is a copolymer of olefin and from 1% to 10% by weight of one of the group consisting of an acrylic acid, a derivative of an acrylic acid, and an ester.

4. A cathode as claimed in either of Claims 1 or 2 where the polyolefin copolymer is a copolymer of an olefin with one of the group consisting of acrylic acid, vinyl acetate and a mixture of acrylic acid and vinyl acetate.

5. A method of making a cathode for electrowinning zinc, the method comprising the steps of:

   providing an aluminum plate (1) having broad flat faces and a narrow edge bridging the faces;

   heating a polyolefin copolymer and extruding it as a strip (6); and
applying the strip (6), while still hot from extrusion, to the narrow edge of the aluminum plate (1).

6. The method of making a cathode as claimed in Claim 5, wherein the strip (6) is applied to a longitudinally extending aluminum band having two longitudinal narrow edges, and including the additional steps of:

applying the strip (6) to both longitudinal narrow edges of said longitudinally extending aluminum band; and

7. The method of making a cathode as claimed in either of Claims 5 or 6 wherein polyolefin copolymer and polyolefins are co-extruded as the strip (6).

8. A method of making a cathode for electrowinning zinc, the method comprising the steps of:

providing an aluminum plate (1) having broad flat faces and a narrow edge bridging the faces;

heating a polyolefin copolymer and extruding it as a strip of polyolefin copolymer (7);

applying the strip of polyolefin copolymer (7), while still hot from extrusion directly to the narrow edge of the aluminum plate (1); and

fitting a strip of polyolefin (8) over the strip of polyolefin copolymer (7) to form a strip (6).
9. The method of making a cathode as claimed in Claim 8, wherein the strip (6) is applied to a longitudinally extending aluminum band having two longitudinal narrow edges, and including the additional steps of:

applying the strip (6) to both longitudinal narrow edges of said longitudinally extending aluminum band; and

cutting up said longitudinally extending aluminum band to form individual cathode-plates.

10. A method as claimed in any one of Claims 5 – 9 including the additional step of welding holding pieces (5) on an edge extending between two edges provided with the strip (6).

11. A method as claimed in any one of Claims 5 – 10, where the polyolefin copolymer is a copolymer of olefin and from 1% to 10% by weight of one of the group consisting of an acrylic acid, a derivative of an acrylic acid, and an ester.

12. A method as claimed in any one of Claims 5 – 10, where the polyolefin copolymer is a copolymer of an olefin with one of the group consisting of acrylic acid, vinyl acetate and a mixture of acrylic acid and vinyl acetate.