

Description

The present invention concerns a process of making a direct glass seal to stainless steel containing chromium.

It has in the past been found difficult to obtain consistent, durable, direct seals between glass and stainless steel, for example, 304L stainless steel, the composition of which is approximately 20% chromium, 10% nickel and 70% iron, that has been annealed in a reducing atmosphere in the process of rolling.

It has been discovered that the reducing atmosphere, for example, hydrogen, depletes the chromium from the surface to a depth of 2.54 μm or 5.08 μm in a 0,381 mm or 0,762 mm sheet. The bonding to steel of glass seals, of the type used in making terminals for hermetic motors, for example, is greatly facilitated by a film of chromium oxide. It has been found that by removing the chromium-depleted layer from the stainless steel to a depth at which there is sufficient chromium to produce a chromium oxide film, and forming the film, a highly reliable glass-to-metal seal can be formed consistently.

In accordance with this invention, generally stated, a process of making a direct glass seal to stainless steel containing chromium, the steel having been annealed in a reducing atmosphere, is provided in which a chromium depleted layer is removed from the surface of the steel to expose core material containing sufficient chromium to produce a continuous chromium oxide film, producing the continuous chromium oxide film through the area to which glass is to be bonded and bonding glass to the metal along the chromium oxide film. The removal can be accomplished by mechanical abrasion or by chemical etching.

According to a preferred embodiment of the invention stainless steel strip, in the specific example, 304L stainless coiled strip of the type produced by Ulbrich Stainless Steels and Special Metals Inc., annealed in a hydrogen furnace, a reducing atmosphere, is sandblasted to remove approximately 5.08 μm of surface, to expose the core material. The sheet before being sandblasted has a gray cast. After being abraded, the surface takes on a greenish cast, indicating that a film of chromium oxide, Cr_2O_3 , has formed. In forming hermetic terminals, of the type shown in Bowsky U.S. Patent No. 4296275, for example, the abraded sheet can be hydroformed, and terminal pins sealed in glass bonded to the stainless steel.

The glass used in the sealing can be of any of the usual sealing glasses used in glass-to-metal seals, sold commercially by Corning Glass Works or the Fusite Division of Emerson Electric Co., for example.

Other means of abrading the surface, such as grinding, wire brushing, or chemical etching can be used, although in the latter, it is necessary to avoid leaching chromium from the surface.

The surface of stainless steel strip that has been stamped or hydroformed can be abraded after the

piece is formed in the area in which glass is to be bonded to the steel. Sandblasting or, depending upon the configuration of the piece, grinding, can be used for this purpose. It is important that the area of the seal be abraded in such a way as to permit the formation of a continuous film of chromium oxide.

Other stainless steels than 304L can be treated in this way, provided they contain enough chromium to form a chromium oxide film. The depth of surface to be removed will depend upon the type of steel and the type of treatment, but it has been found to be very thin, as indicated, in commercially available stainless steel strip. In any event, the proper depth of abrasion is easily determined by observing the appearance of a green cast to the surface.

Claims

1. The process of making a direct glass seal to stainless steel containing chromium, said steel having been annealed in a reducing atmosphere, characterized in comprising removing from the surface of said steel through the area in which glass is to be bonded to the steel a chromium depleted layer to expose core material containing sufficient chromium to produce a continuous chromium oxide film, forming said chromium oxide film, and bonding glass to said steel along said chromium oxide film.

2. The process according to claim 1, characterized in that the chromium depleted layer is removed by mechanically abrading said layer.

3. The process according to claim 1 or 2 characterized in that the stainless steel is 304L stainless.

Patentansprüche

1. Verfahren zur Herstellung einer direkten Glasverschmelzung mit Chrom enthaltendem rostfreien Stahl, der in einer reduzierenden Atmosphäre geglüht worden ist, gekennzeichnet durch Entfernen einer chromarmen Schicht von der Oberfläche des Stahls in dem Bereich, in welchem Glas mit dem Stahl verbunden werden soll, um Kernmaterial freizulegen, das ausreichend Chrom enthält, um einen durchgehenden Chromoxidfilm zu erzeugen, Bilden des Chromoxidfilms und Verbinden des Glases mit dem Stahl längs des Chromoxidfilms.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die chromarme Schicht durch mechanisches Abschleifen der Schicht entfernt wird.

3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der rostfreie Stahl rostfreier Stahl des Typs 304L ist.

Revendications

1. Procédé de formation d'un scellement de verre directement sur un acier inoxydable contenant de chrome, cet acier ayant subi un recuit dans une atmosphère réductrice, caractérisé en ce qu'il comprend l'élimination de la surface de

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According to a preferred embodiment of the invention stainless steel strip, in the specific example, 304L stainless coiled strip of the type produced by Ulbrich Stainless Steels and Special Metals Inc., annealed in a hydrogen furnace, a reducing atmosphere, is sandblasted to remove approximately 5.08 μm of surface, to expose the core material. The sheet before being sandblasted has a gray cast. After being abraded, the surface takes on a greenish cast, indicating that a film of chromium oxide, Cr_2O_3 , has formed. In forming hermetic terminals, of the type shown in Bowsky U.S. Patent No. 4296275, for example, the abraded sheet can be hydroformed, and terminal pins sealed in glass bonded to the stainless steel.

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Patentansprüche

1. Verfahren zur Herstellung einer direkten Glasverschmelzung mit Chrom enthaltendem rostfreien Stahl, der in einer reduzierenden Atmosphäre geglüht worden ist, gekennzeichnet durch Entfernen einer chromarmen Schicht von der Oberfläche des Stahls in dem Bereich, in welchem Glas mit dem Stahl verbunden werden soll, um Kernmaterial freizulegen, das ausreichend Chrom enthält, um einen durchgehenden Chromoxidfilm zu erzeugen, Bilden des Chromoxidfilms und Verbinden des Glases mit dem Stahl längs des Chromoxidfilms.

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1. Procédé de formation d'un scellement de verre directement sur un acier inoxydable contenant de chrome, cet acier ayant subi un recuit dans une atmosphère réductrice, caractérisé en ce qu'il comprend l'élimination de la surface de



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cet acier sur la zone où le verre doit être fixé à l'acier d'une couche appauvrie en chrome pour exposer la matière centrale contenant suffisamment de chrome pour produire un film d'oxyde de chrome continu, former ce film d'oxyde de chrome, et fixer le verre à cet acier le long de ce film d'oxyde de chrome.

2. Procédé selon la revendication 1, caractérisé à ce que la couche appauvrie en chrome est éliminée par abrasion mécanique de cette couche.

3. Procédé selon l'une quelconque des revendications 1 ou 2, caractérisé en ce que l'acier inoxydable est l'acier inoxydable 304L.

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