PROTECTION OF TERMINAL METALLURGY DURING WORKING AND REWORKING OF GAS DISCHARGE DISPLAY DEVICES

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ABSTRACT

A water removable material ordinarily used as a brazing stop-off — i.e. to restrict the flow of a molten metal and thereby to prevent wetting of an underlying surface in a brazing or soldering process — has been found useful presently as a means to prevent oxidation of, or other damage to, terminal metallurgy of mettallized glass components during protracted periods of baking, gas-filling and glass sealing processing incidental to fabrication of gas discharge display panel assemblies. The subject baking, gas-filling and sealing processing involves hours or even days of variant temperature treatment, which should be distinguished from seconds or at most minutes of brazing treatment. The protective function required of the water removable coating during this prolonged processing period is considered unique and eliminates certain application and removal process operations associated with the use of other protective media (e.g. sintered glass frit).

4 Claims, No Drawings
PROTECTION OF TERMINAL METALLURGY DURING WORKING AND REWORKING OF GAS DISCHARGE DISPLAY PANELS

CROSS-REFERENCE TO RELATED APPLICATIONS


BACKGROUND OF THE INVENTION

Assembly of plasma or gaseous discharge display panels, or like devices, from metallized glass components generally involves long periods of process handling at high temperatures under diverse vacuum and gaseous ambient conditions. Naturally this subjects the component metallurgy to severe stress and oxidation. Protection of the component metallurgy during such processing has been accomplished hitherto by coating the entire metallurgy with a not-too-easily removed but highly impervious dielectric protective medium (e.g. sprayed-on and fired glass frit). This coating is subsequently removed from terminal connecting portions of the metallurgy by selective etching, after completion of the cleaning, gas-filling and sealing stages of processing.

Once the terminal coating has been removed the process is irreversible, since for reapplication the coating would have to be fired under thermal conditions adverse to the integrity of seals, exhaust ports and other constituents of the processed device. Thus it is neither feasible nor economically convenient to consider a reworking operation if the processed device is later found to be defective. Furthermore even in the direct working the selective etching of the coating to remove it from terminal connection areas of the metallurgy is costly and inconvenient since the part must be masked by a suitable etch resist requiring additional application and removal handling.

Accordingly an object of the present invention is to provide an improved method for protecting terminal metallurgy during working and/or reworking of gas discharge display panels.

Another object is to prevent oxidation of gas panel metallurgy at external connection sites, during working and/or reworking of the panel assembly, by means of materials which are economical and convenient to apply and remove, and which can be compatibly reapplied to permit high temperature reworking of imperfect devices.

We have found that particular water removable brazing stop-off material can be compatibly applied to and removed from terminal connection areas of metallized glass (chrome-copper-chrome terminal metallurgy on soda-lime silica glass substrate) elements useful as components of gas discharge panel assemblies without adverse effect, and that such application is virtually as effective as fired glass frit in preventing oxidation of the terminal metallurgy during long term handling of the components in baking, gas-filling and sealing operations of panel assembly. Since the stop-off need not be fired it can be compatibly reapplied to permit reworking of an assembly where glass films could not be so used.

The foregoing and other objects and features of the invention will be more fully understood and appreciated by considering the following detailed description of a specific embodiment.

DETAILED DESCRIPTION

Patent applications referenced above under Cross-References to Related Applications provide extensive teaching of component composition and processes of assembly for constructing gas discharge display panels. Accordingly, only so much of the process and component composition as is relevant to the present invention will be considered specifically below.

A typical panel under consideration is constructed by sealing together peripheral edges of a pair of glass plate components spaced by glass spacing rods, to form a gas chamber space, and filling the space with a suitable gas. The plates (e.g. soda-lime silica) are pre-processed to include crossed array patterns of conductive line electrode metallurgy (e.g. Cr-Cu-Cr) which form discharge conducting electrodes at crossover points. The gas discharges emit light and are selected combinationally to form comprehensible display indications.

In the elevated temperature sealing process and in the gas-filling process the electrode metallurgy must be protected by a coating medium which is suited to the conditions of these successive processes. One medium known to fulfill such conditions is a film of glass applied as a sprayed frit over the entire component surface containing the electrode metallurgy and subsequently fired. Subsequent to assembly processing the protective film must be removed from edge areas of the metallurgy to which external power and/or signal connections are to be made. For this purpose the fired glass film above is selectively etched with a suitable etch resist mask covering the film parts which are to be retained. Quite obviously the firing of the film, the resist application and removal operations and the etching operation represent significant cost and handling factors in the overall assembly process. Also, once the film has been removed from the completed assembly, so that electrical test signals may be applied to the electrode edge terminations, it is no longer possible to reapply the film for reworking of defective assemblies since the film firing conditions are incompatible thermally with assembly sealing materials and structures.

Our alternative protective medium and method thus offers several advantages; especially in reworking operations. Our method consists of a local spray application of specific brazing stop-off material described below, over the external connection edge areas of the electrode metallurgy of the glass plate components. The remaining metallurgy is simply masked (e.g. by paper or masking tape). Thereafter a spray application of glass frit is placed over the remaining metallurgy with the brazing stop-off loosely covered by any convenient and suitably non-adherent masking object (e.g. cardboard). Finally the component which is now covered with a composite stop-off and glass frit coating is fired to fuse the frit into a unified film while coincidentally drying the stop-off coating.

With the composite coating just described the glass plate components are processed into gas-filled panel assemblies by:

a. Arranging plates, spacer rods and sealant (e.g. additional glass frit) in suitable orientation.
b. Sealing the arranged components into a unit by temperature cycling in a suitable oven at the following program of temperatures: Binder Bakeout — 6°C/Min. to 70°C — then 1°C/Min. to 400°C — hold at 400°C 1 hour — cool to room temperature at 1°C/Min. Panel Seal — 6°C/Min. to 200°C — 1°C/Min. to 500°C — hold at 500°C 1 hour — cool to room temperature at 1°C/Min.

c. Forming an exhaust and gas-filling tube structure by using a suspension of Corning 7570 glass to seal on tubulation and firing during panel seal step.

d. Sealing the tube structure to a vacuum/gas back filling system and gas-filling conduit by glass to glass seal or by O-ring type quick connect.

e. Evacuating the assembly interior space through the tube structure.

f. Baking out the interior space at 400°C for about 8 hours (cycle up 1° per minute and down 1° per minute) to remove residual gases and impurities.

g. Filling the space with neon-argon gas.

h. Separating the tube structure from the filling conduit, and sealing it to close off the interior space, by tipping off in an oxygen-illuminating gas flame or by electric heating.

i. Removing the stop-off coating with water as described below.

The stop-off coating preparation is a slurry mixture of Alumund (aluminum oxide), nitrocellulose, butyl alcohol and butyl acetate available in a form ready-made for use under the commercial designation Nicrobraz Green. Or else it may be prepared by a procedure described and characterized as providing the equivalent preparation in "Handbook of Electron Tube and Vacuum Techniques" by F. Rosebury (Addison Wesley, Publisher) Pages 81, 82 and 358.

The preparation is formed by mixing approximately 0.08 pounds of 1000-sec nitrocellulose (the binder) dissolved in equal parts of butyl alcohol and butyl acetate (about 1 gallon of mixed solvents) to a viscosity of 17.5±0.1 centipoises at 74°F. To 1,000 cc of the binder add 635 grams of Norton No. 38-900 special acid washed alumund. Then dilute with 705 cc of equal parts of butyl alcohol and butyl acetate and mix thoroughly.

The preparation is applied over the edge metallurgy of the glass plate components by: spraying, silk screening, brushing on or any other equivalent technique and allowed to dry.

The Nicrobraz-Green or equivalent coating is removed from the processed assembly by immersion in tap water at 25°–80°C from faucet, with suitable agitation as: mechanical brushing or rubbing.

For rework of defective assemblies Nicrobraz is reapplied over the exposed edge metallurgy and the filling step and other steps of the assembly process are repeated. The reapplied coating is then removed from the reworked assembly baring the edge metallurgy again for connection with test equipment and/or other active electrical sources.

Other stop-off media which are useful as above are: Nicrobraz Red but with poorer results.

We have shown and described above the fundamental novel features of the invention as applied to several preferred embodiments. It will be understood that various omissions, substitutions and changes in form and detail of the invention as described herein may be made by those skilled in the art without departing from the true spirit and scope of the invention. It is the intention therefore to be limited only by the scope of the following claims.

What is claimed is:

1. A method of protecting semi-transparent delicate electrical circuit surface metallurgy of glass based components of a gas discharge assembly in an assembly working or reworking process, which is characterized by application of a dielectric protective medium over the metallurgy before assembly processing and removal of a portion of said protective medium after said processing, said method comprising:

coating peripheral parts of said component metallurgy selectively with a water removable brazing stop-off preparation to prevent oxidation of said peripheral parts in subsequent handling;

coating other parts of said component metallurgy with a film of insulating material stable at high temperatures and serving as permanent encapsulation for said other parts;

assembling and fusion processing pairs of said components to form heat-sealed gas discharge display panel units each having a sealably enclosed envelope substantially confined to the space between said other parts of the fused components; and

removing said water removable stop-off coating from said peripheral parts by applying water to said assembled and processed units.

2. A method of working and/or reworking steps of a gas discharge display panel assembly glass fusion sealing process, in which a sealed envelope containing a specific gas is formed by gas-filling and heat fusion processing of metallized glass components said metallization centrally encapsulated in a protective permanent dielectric film and including peripheral terminal connection sites requiring exposure to effect connection, said method comprising:

selectively coating said terminal sites with a water removable brazing stop-off preparation useful to prevent oxidation of said sites during said gas-filling and fusion process handling;

working or reworking said filling and fusion process steps; and

removing said stop-off coating from said terminal sites with an application of water.

3. The method of claim 2 in which said brazing stop-off preparation is a mixture of aluminum oxide, nitrocellulose, butyl alcohol and butyl acetate formed by mixing equal parts of butyl alcohol and butyl acetate to form a solvent mixture and dissolving in a portion thereof nitrocellulose, in the proportion 0.08 pounds of nitrocellulose per gallon of the solvent mixture portion, yielding a binder mixture and adding to each 1000cc of the binder mixture 635 grams of aluminum oxide and diluting the resultant binder/aluminum oxide mixture with 705cc of the solvent mixture per 1,000cc of binder.

4. The method of claim 2 in which said water removal step includes agitating the said coating by rubbing or brushing while rinsing the coating with running water.