Technology Offer

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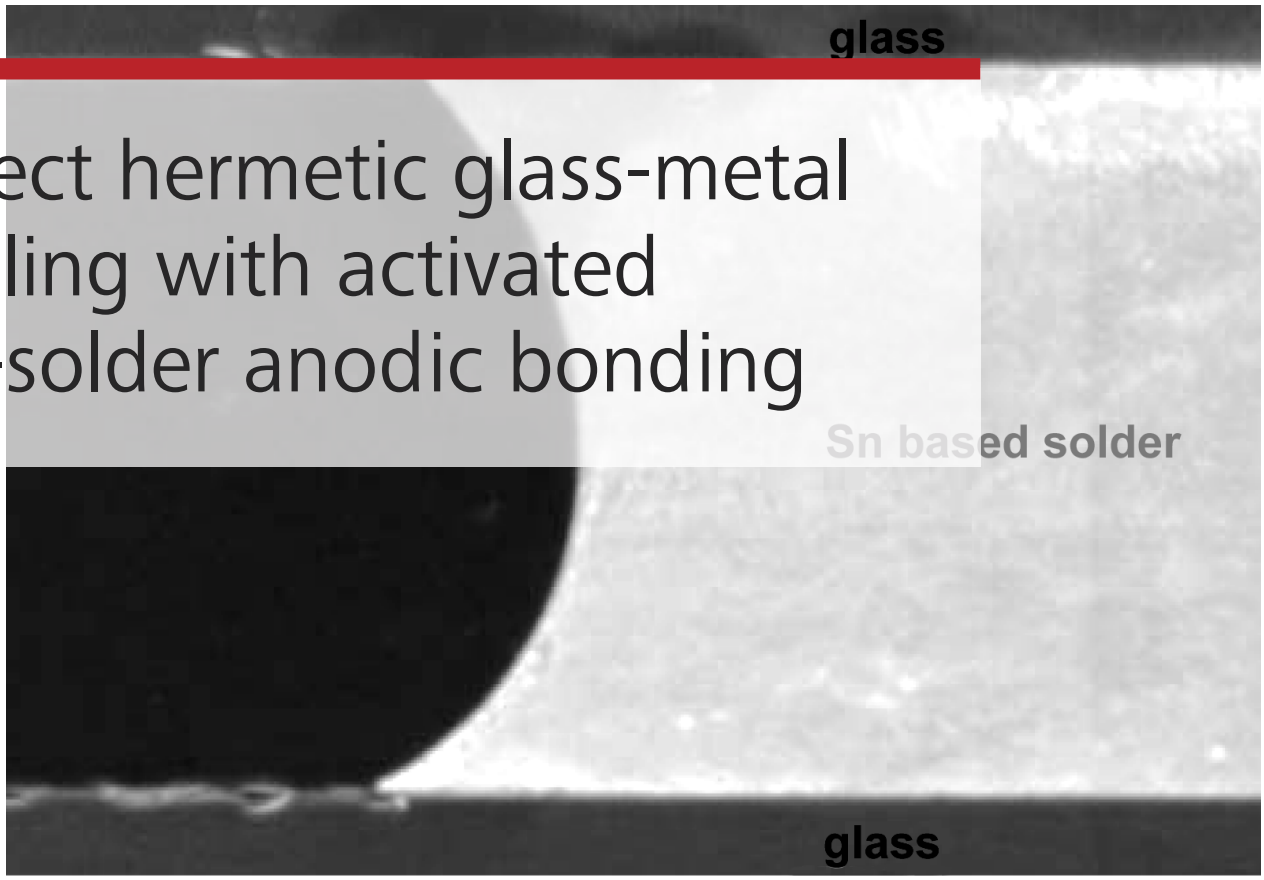
Direct hermetic glass-metal sealing with activated tin-solder anodic bonding



Invention

The invention allows the single step formation of a joining object composed of glass and a tin based soft solder metallic seal. Robust hermetic seals can be obtained within minutes in a single step and without the need for premetallization. The technology has a wide range of potential uses from vacuum glazing sealing to semiconductor packaging applications and is both economical and scalable.

Background

Standard glass sealing is done either by using glass solders (low melting glasses) or multilayer bonding approaches meaning either premetallization and soft soldering or formation of a multilayer structure and anodic bonding of the metallic side (typically an Al film) to the glass. Glass soldering is typically carried out at temperatures of 450°C or higher which can cause material and/or compatibility problems. Premetallized soldering and anodic bonding of multilayer structures require additional working steps which complicate the process and entail higher cost and failure susceptibility.

Advantages

The method is a single step process which means that compared with conventional technology sealed objects can be manufactured with identical or better quality while eliminating an additional production step. Activated solder anodic bonding combines low process temperature (250°C – 350°C), practicability over a large pressure range (from atmospheric to high vacuum), rapid bonding times and extreme hermeticity and uses inexpensive raw materials and technologies. This combination adds up to a significant advantage in resource and cost effectiveness.

Applications

In vacuum glazing, the glass solder approach as a non-vacuum compatible method could be replaced by activated tin-solder anodic bonding. Thus, many problems associated with the manufacture could be circumvented, opening up the possibility for a new generation in both production and energy efficiency (Figure 1). This technology is currently being implemented into a small pilot scale for the fabrication of 0.5m by 0.5m glazings (Figure 2). The same technology could alternatively be used for but not limited to sealing of PV elements or OLED display panels and semiconductor / MEMS packaging.

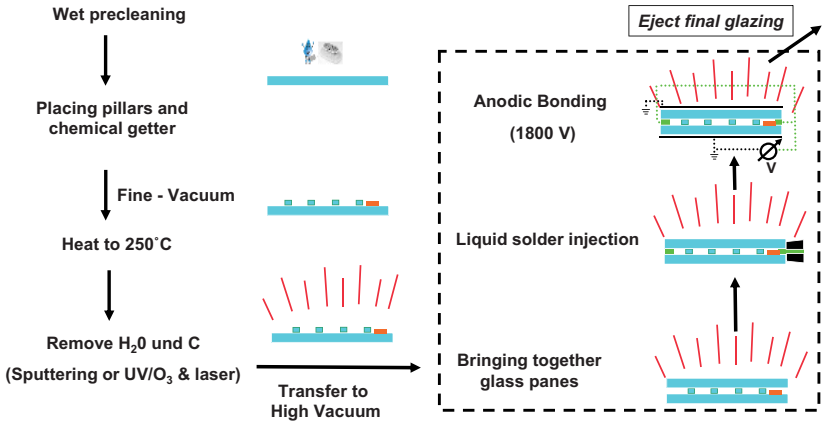


Figure 1

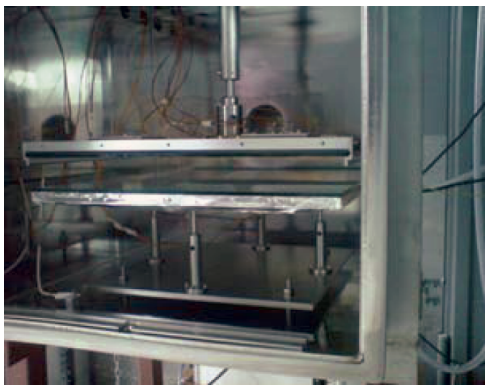


Figure 2

Ownership

Empa, Swiss Federal Laboratories for Materials Testing and Research,
Überlandstrasse 129, CH-8600 Duebendorf, patent pending

References

Schjølberg-Henriksen, K.; Poppe, E.; Moe, S.; Storas, P;. Taklo, M.M.V; Wang, D.T.; Jakobsen, H.; "Anodic bonding of glass to aluminium", Microsyst. Technol., 12(5), 2006, 441-449 (allgemein anodic bonding Al zu Glas)

B. Lee; S. Seok and K. Chun "A study on wafer level vacuum packaging for MEMS devices" J. Micromech. Microeng. 13, 2003, 663–669 (MEMS, Halbleiter)

Keywords

Anodic bonding, glass-to-metal seal, hermeticity, soft solder, high-vacuum

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