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DIFFUSION WELDING OF ALUMINOSILICATE GLASS S48-3 WITH MOLYBDENIC ALLOY TsM-2A

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Diffusion welding is the only bonding technology which allows obtaining qualitative one-piece joints of metallic materials with nonmetallic materials in various combinations [1,2]. In particular, it is applied to the bonding of aluminosilicate glass S48-3 (C48-3) and molybdenic alloy TsM-2A (ЦМ-2А), widely used in precision instrument-making industry, in electronic and electric devices.

The main requirements for such devices (besides achievements of the strength of joint at the level of the strength of bonded materials) are:

- provision of hermeticity of the joint at the level from $5 \cdot 10^{-12}$ $m^3 \cdot Pa/s$ to $1 \cdot 10^{-10}$ $m^3 \cdot Pa/s$ for all the operating period and also after thermocycling in the temperature range from minus 65°C to +55°C;
- value of residual thermal stress in the welded joint shall not be more than 10 MPa;
- parts after welding shall not have changes of their geometric sizes.

Diffusion welding of the parts made of the above materials may be carried out by two technology process schemes:

1. Bond the glass with the alloy directly to each other. In this case, the qualitative joint is formed at the temperature T > 700°C, which is close to the temperature of glass softening (T_s = 810°C). But even at a minimum force of squeeze (P = 0.5 kgf/mm^2), the glass begins to deform plastically.

2. Apply an interfacial layer of 0.1 mm thickness aluminum foil in order to lower the welding process temperature. At that, of course, in the zone of joining will form intermetallic compounds of the Al-Mo system. As the welding temperature increases, there also increases the formation speed and amount of intermetallic compounds in the welded joint. Microfractures and nonsolid areas appear in the zone of intermetallic compounds formation. They have a negative impact upon the hermeticity of joint.

Nevertheless, the diffusion welding mode with T=600°C, P>5 kgf/mm^2 and t=30 min provides fulfillment of the announced requirements. It is connected with the fact that the applied welding pressure deforms plastically the intermetallic compounds and provides seizing with the main material.

The same effect can be achieved if foils of titanium and aluminum are used as interfacial layers; at that, at first, a diffusion welding of the titanium foil with the molybdenic alloy is to be carried out, and then the aluminum foil is to be placed in between the welded titanium foil and the glass, and the diffusion welding is to be carried out with the above given parameters.

REFERENCES

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