Degradation Processes on the Interface of Film Systems "Glass - Klaster Ag-Pd" - Sn-Pb

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Influence of structural - phase features of conductor films based on " glass - Ag-Pd " on processes of physical and chemical interaction of a film material with the solder STP-61 is investigated.

Researches have shown, that main reason of degradation (partial or full destruction of contact compounds "glass - Ag-Pd"-STP-61) is: bad adhesion of a film to ceramic substrate; dissolution of a film material in solder melt; solder melt penetration on pores and microcracks through the appreciable heterogeneity and nonthickened conductor macrostructure. System Ag-Pd-Sn-Pb element concentration distributions on diffusion zone depth are received. It is established, that interaction the Sn-Pb melt (at temperature 250^0 C) with a thick film material results in a strong redistribution of the basic solder components (segregation) with Sn extracting in a contact zone and Pb crystallization on a distance of 60-70 microns from the interface. It is possible to explain such redistribution by the presence of dissolution process which passes on two mechanisms: a kinetic mode - diffusion through interphase border; diffuse (heterodiffusion of the dissolved metal in the liquid melt). The equations which describe solution kinetics are received. For a kinetic mode: $n = n_\infty \{1 - \exp[-(\varpi_\tau \rho / n_\infty)(S / V_{ж})t]\}$; for diffuse mechanism: $n = n_\infty \{1 - exp[-(D/\delta)(S/V_{ж})t]\}$, where n - metal solution concentration, n_∞ - saturation concentration; ω – crystallization speed; ω_τ - probability of the firm metal in liquid transition, ρ- firm metal surface density; S - contact area; $V_ж$ - liquid solder volume; δ - boundary layer thickness. In our case when both mechanisms operate: $n = n_\infty \{1 - \exp[-\alpha(S/V_{ж})t]\}$, where $\alpha = (V_{ж}/S)\ln[n_\infty/(n_\infty - n)]$ - dissolution speed constant.

It is established, that formation in an initial glass matrix intermetallic compound Ag_xPd_y and solvate systems complex spatial structure such as $Me(OH_2)$ blocks tin diffusion in a matrix and inhibits dissolution of its other components (Ag, Pd) in tin - lead melt. At presence in a glass matrix intermetallic compounds Ag_xPd_y and solvate systems of complex spatial structure such as Me (OH_2) film adhesion to a ceramic substrate is high and makes 5-10 MPa.