Eliminating Flux Residue In Opto-Electronic Packages

With the advent of opto-electronic hermetic packages, it has become necessary to significantly reduce, if not eliminate, foreign materials that can cause reliability problems on the optical components inside the package. One material that has been identified as a possible source for unwanted deposits is flux residue from soldering processes. Obviously, removing the flux residue by means of cleaning is an option. However, the final steps of sealing the package do not lend themselves to cleaning. In such cases, an alternate approach to the traditional soldering process utilizing flux needs to be employed. This application note will discuss some methods to achieve a hermetic package free of flux residues. These recommendations can be used in concert with one another.

1) **Pre-tinning the Mating Surfaces:**
   This is probably the simplest and easiest approach since it still allows for the use and removal of flux.

   Apply flux and solder to the individual mating surfaces and reflow using the conventional process. Next, clean off ALL of the flux residue with the appropriate cleaner or solvent. (Be careful to allow the surfaces to dry so that cleaning materials do not get trapped inside the package.) Mate the surfaces together and heat to reflow temperature. The separate soldered surfaces will fuse together.

2) **Use Surface Platings and Solder Alloys that Do Not Require a Flux:**
   One of the most important functions of a flux is to reduce surface oxides on the metals to be attached. A good way to avoid the necessity of using flux is to avoid metals prone to oxidation. Gold is a metal that is relatively oxide-free.

   It is important to have a good layer of gold on the surfaces to be soldered. Next, an appropriate solder alloy has to be chosen:

   a) A high gold-containing alloy, such as Au80/Sn20, is an excellent option. Because it is high in gold content, the alloy itself tends to be low in oxide formation. This eutectic alloy, which has a melting temperature of 280°C, also provides excellent strength and can handle high-operating temperatures. Two disadvantages of this alloy are the high soldering temperature required and the cost.

   b) In fluxless applications where a lower soldering temperature is needed, high indium-containing alloys can be used. Although not as oxide-free as gold, the oxide layer that does form is thin (pure indium forms an 80-100 angstroms-thick layer of oxide at ambient) and can be easily etched using a 2-5% by volume hydrochloric acid solution. Handling and soldering under nitrogen facilitates the process by preventing oxides from reforming.

3) **Plate Mating Surfaces with Solder:**
   Surfaces can be plated with pure indium (indium sulfamate plating bath), pure tin, or a tin-lead alloy. Plate the desired amount onto each surface. Mate the two surfaces together. Then reflow so that the soldered surfaces flow together and bond to the substrates. It is important not to let the plated surfaces experience long lapses of time between plating and reflow. Extended delays will allow the substrates and solder to oxidize. This oxidation may inhibit the solder's ability to adequately bond.

4) **Reducing Atmospheres:**
   Reducing atmospheres (5-12% hydrogen, balance nitrogen) can be used to remove surface oxides and promote wetting. The higher temperatures (~350°C) required may limit the use of this procedure in temperature-sensitive applications.

APPLICATION NOTE

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