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An Evaluation of the Effective Experimental Factors on the Solderbility of Cu and Pb-Sn

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1. introduction

An accurate assesment of manufacturing solderbility of components and printed wring boards before actual soldering is vital to achievement of low defect levels in manufacturing. The identification of a solderbility test that adequately predicteds in-line solderbility has become even more important with the increased use of surface mount technology, in which the ability to inspect and rework is limited. As a starting place in designing robust tests for solderbility and storage lifetimes, we have chosen to examine the critical factors in the wetting balance test as the solderbility test and steam aging as the accelerated storage test. The Taguchi Method was used to evaluate individual and interactive effects of the steam aging factors and the wetting test factors. Different response surfaces were generated by choosing different features of the force-time curve from the wetting balance test.

2. Experimental procedure

The materials used were pure Cu(0.5mm thick, 99.999%,OFHC) substrates and liquid solder of Pb-Sn eutectic composition. For the steam aging all samples were heated between 100deg C and 150deg C, for time intervals of 30 min to 3hr. Using a humidity sensor(Rotronic Inst. Co. HT250R), the relative humidity was controlled. A wetting balance (Multicore Universal Solderbility Tester) was used to test the wettability of all of the samples using a range of wetting test factors.

Statistical analyses like the level average analysis of the Analysis of Variance(ANOVA) by the Taguchi method were performed. The statistical analysis data were evaluated considering possible changes in the surface (phase transformation, adsorption and reaction at liquid-solid interface) during steam aging and wetting. To identify new phases on the surface of the steam aged pure Cu foil, X-ray glancing angle diffractometry, Raman spectrometry, and TEM are being used. The oxide layer thickness of the steam aged sample is being estimated by an electro-chemical methods. The surface and interface morphology are being observed by optical microscopy, SEM, and TEM.

3. Result and Discussion

Of all of the solderbility factors, the strongest factor is the flux type and the strongest interaction is the flux type and solder bath temperature. The response surface that shows the greatest change with changes in the factors is different for the wetting test factors and the steam aging factors. In the case of the wetting test factors, the maximum response parameter for the steam aging factors is the withdrawal force. These results imply that a combination of responses of the wetting forces are required to evaluate the effect of multiple factors on solderbility. The surface characterization of the steam aged samples is still being performed, so only preliminary results will be presented in this talk.

4. Reference

1) R.J. Klein'Wassink(editor): "Soldering in Electronics" 2nd, Elctrochemical Pub. Ltd Buckingham(1989)

2) Glen stuart Peace (editor): "Taguchi Method-A Hands-On Approch" Addison-Wesley Pub. Co Reading(1993)

3) J.L. Jellison et al.: IEEE Trans. Part, Hybrids, & Pack., 12,2, June(1976)p126-133