Surface Spectroscopy

Objective

The objective is to provide an affordable rapid and nondestructive assessment of the solderability of printed wiring boards (PWBs) coated with organic solderability preservative (OSP). Surface characteristics, such as oxide structure and quantity, have a direct link to the ability of the surface to wet molten solder (solderability).

Benefits

Real-time, nondestructive, rapid solderability measurements of components and materials are currently not available to the electronics industry. The inability to rapidly troubleshoot solderability problems also causes significant cycle-time delays when problems arise. Finally, with the miniaturization of electronics and use of organic and organometallic preservatives, the ability to measure the solderability of both high density components and coated board metallization becomes nearly impossible.

Applicable Weapon Systems

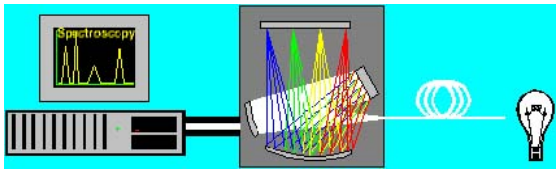
This technology will be applicable to numerous weapon systems. Initial demonstration vehicles include the HARM missile, MK86/UYK-7 Navy Computer, JDAM, and the Precision Lightweight GPS Receiver (PLGR). In addition, there are numerous commercial applications for this technology.

Technical Approach

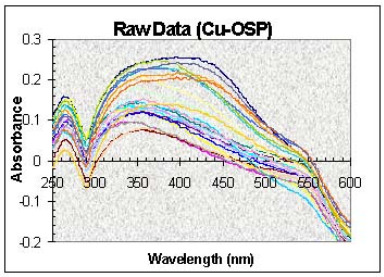
First, a variety of surface reflectance spectrographic methods were evaluated, including ellipsometry; infrared and near infrared; Raman; ultraviolet and visible. The results were compared on the basis of utility, ease of use and affordability. The most advantageous system utilized UV-visible spectroscopy.

Next, using a prototype reflectance spectrophotometer constructed from commercial off-the-shelf (COTS) components, the reflectance properties of virgin and variously aged (oxidized) copper samples were recorded and compared to the results of other accepted measurements of solderability. At the same time, software was developed to automate the spectral interpretation and translate the result into useable data for assessing substrate solderability.

The value of this effort to PWB manufacturers was presented at an IPC conference on surface finiishes and PWB solderability



Reflectance spectroscopy compares the light reflected from the substrate to the reflected light from a reference standard.



Superimposed reflectance UV spectra from an aging study of OSP-coated copper