

Comparative Study of Chlorine Content Determination in Printed Circuit Boards using a Benchtop XRF and a Handheld XRF

Federica Bogani, Federica.bogani@intel.com; Emma Gates, emma.c.gates@intel.com; Andrew Wilson, Andrew.r.wilson@intel.com

Intel Corporation, Hillsboro (OR)

Due to the increasing requirements dictated by regulations and industry standards, the electronic industry is rapidly moving toward halogen free printed circuit boards. Chlorine is being regulated because at high levels it constitutes a pollutant for the environment and it's toxic to the human body.

For example, more and more companies are opting to follow the JEDEC Low Halogen standard which requires chlorine in laminates to be below 900 ppm and chlorine and bromine combined to be below 1500 ppm. More regulations and standards that dictate the content of chlorine in printed circuit boards may become active in the future. Thus, the availability of a fast and reliable method for determination of Chlorine in printed circuit board is paramount.

Chlorine in printed circuit boards can be determined by X-ray fluorescence (XRF) spectrometry. Determination of chlorine in printed circuit boards represents a challenge for several reasons: it is a so defined 'light' element for X-rays, thus originating weak emissions and causing a poor signal to noise ratio; it has low penetration depth, limiting the analysis to a surface analysis; printed circuit boards are made of non-homogeneous material.

This study aimed to determine the accuracy of chlorine content determination when comparing a Benchtop XRF to a Handheld XRF and to results obtained from Combustion Ion Chromatography (CIC). Results from uncut printed circuit boards were also compared to results obtained on ground printed circuit boards. The measurements were gathered as surface measurements first at specific locations, then the printed circuit boards were ground to fine powder and measurements were repeated.

The data show some discrepancy between the Benchtop and Handheld XRF and to results from CIC. In addition, numbers are significantly different when comparing data obtained on whole printed circuit board to ground printed circuit boards.