

Determination of hazardous substances according to RoHS

Energy-dispersive X-ray Fluorescence Spectrometer



Large sample compartment with camera option for easy positioning of the sample. More about the EDX-HS system on page 28

Energy-dispersive X-ray fluorescence is a fast and simple analytical method for the determination of compounds which are addressed under the RoHS ("Restriction of the use of certain Hazardous Substances") directive. This directive on the limited use of certain hazardous compounds has been integrated into national legislature by the European Union member states. The new legislature will come into effect on July 1, 2006 and will restrict the use of lead, mercury, cadmium, hexavalent chromium and two brominated flame retardants which are used in the manufacture of electrical and electronic equipment.

The RoHS directive applies to all electrical household equipment, consumer electronics, IT- and telecommunication equipment, lamps and lights, electronic tools, toys, electronic medical equipment, monitoring and control instruments as well as slot- or vending machines. There are

exceptions for certain applications, but otherwise the threshold values apply to the above-mentioned compounds, for instance 100 mg/Kg for cadmium or 1,000 mg/Kg for lead. These threshold values are derived from element concentrations per unit weight of the homogeneous sample material.

Shimadzu, one of the world leaders in analytical instrumentation, offers within its wide product range numerous systems which are able to detect the lowest concentration levels of hazardous compounds. For instance, in the analysis of cadmium, concentrations as low as 0.1 mg/L can be detected using atomic absorption spectrometry in the flame atomisation mode while the digital graphite furnace mode with electrothermal atomisation can detect concentrations even as low as 0.1 µg/L. For the determination of hexavalent chromium it is recommended to use UV-VIS spectrometry. This is implemented quickly and easily in the routine laboratory using the UVmini-1240. Polybrominated biphenyls as well as polybrominated diphenyl ethers are analysed by FTIR spectrometry using the IRPrestige-21 or the GCMS-QP2010 systems.

Development of a routine analysis method

In the context of a research cooperation with the ERA Technology Ltd. Research Institute in Leatherhead, U.K., a Shimadzu EDX-700HS energy-dispersive X-ray fluorescence spectrometer was used for RoHS determination of hazardous substances

with the goal of developing a routine RoHS compliant analytical method for conventional construction parts such as circuit boards, cables and electronic parts. Furthermore, it should be possible to position the sample directly in the sample compartment for a non destructive measurement.

The results confirm that energy-dispersive X-ray fluorescence is a high-performance and flexible analytical method. However, it was also apparent that depending on the sample material, the choice of system parameters played an important role in obtaining the correct result. The EDX-700HS with its flexible system configuration guarantees the highest possible reliability of the analytical data.

The research results were presented on October 21, 2004 during the international "Lead-free Conference" * in Frankfurt, Germany, by Dr. Chris Robertson, ERA Technology Ltd., Leatherhead, under the following title: "A case study of energy-dispersive X-ray fluorescence as a tool for RoHS compliance analysis". A special reprint of the publication is available upon request.

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* IPC/JEDEC 7th International Conference on Lead Free Electronic Components and Assemblies