

Detection limits of RoHS target elements and P·Cl·Sn·Sb in various materials 2020. 05

In addition to the elements subject to RoHS (Cd·Pb·Hg·Br·Cr;) under the new REACH regulation, P, Cl, Sn, Sb in various materials have received attention as new restricted elements. Lower detection limits for these elements in EA1400 are presented.

The lower limit of detection varies depending on the measurement time, collimator size, matrix difference and the presence or absence of interfering elements. The lower limit of detection shown here is an example and not a guaranteed value.



EA1400

Definition of Detection Limit

Using the following formula, the concentration corresponding to 3 times the statistical fluctuation of background intensity is defined as the lower limit of detection (DL).

$$DL = 3\sigma = 3 \times \frac{C}{I_{NET}} \times \sqrt{\frac{I_{BG}}{LT}}$$

C: Concentration of element (mg/kg)
I_{BG}: Background intensity (cps)

I_{NET}: Net intensity of element (cps)
LT: Live time (s)

Detection limits of target elements in various materials

The lower detection limits of Cd·Pb·Cr·Hg·Cr·P·Cl·Sn·Sb in PE and PVC, Cd·Pb·Cr in aluminum alloys and brass, Pb·Cr in steel and lead-free solder (SAC305) are calculated.

Conditions

Table 1 conditions of target elements

Target element	Cr	Cd·Sn·Sb	Pb·Hg·Br	P	Cl
Tube Voltage	15 kV	50 kV	50 kV	15 kV	15 kV
Tube Current	Auto	Auto	Auto	Auto	Auto
Primary Filter	For Cr	For Cd	For Pb	OFF	For Cl
Analysis Line	Cr K α	Cd K α Sn K α Sb K α	Pb L α * Hg L α Br K β	P K α	Cl K α
Collimator	Φ5 mm	Φ5 mm	Φ5 mm	Φ5 mm	Φ5 mm
Measurement Time	300 s	300 s	300 s	300 s	300 s
Environment	Air	Air	Air	Air	Air

* Pb Analysis Line: Pb L β is used for Pb measurement in solder.

Detection Limit

Table 2 Detection Limits of of RoHS target elements

Element	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	Br (mg/kg)	Cr (mg/kg)
PE	1.3	0.15	0.15	3.1	0.36
PVC	1.4	0.54	0.61	2.0	3.6
Al alloy	1.0	0.72	—	—	2.4
Brass	3.8	14	—	—	12
Steel	—	6.8	—	—	16
Solder	—	5.2	—	—	—

Table 3 Detection Limits of of P·Cl·Sn·Sb

Element	P (mg/kg)	Cl (mg/kg)	Sn (mg/kg)	Sb (mg/kg)
PE	7.0	5.3	3.0	4.0
PVC	29	—	3.0	3.6