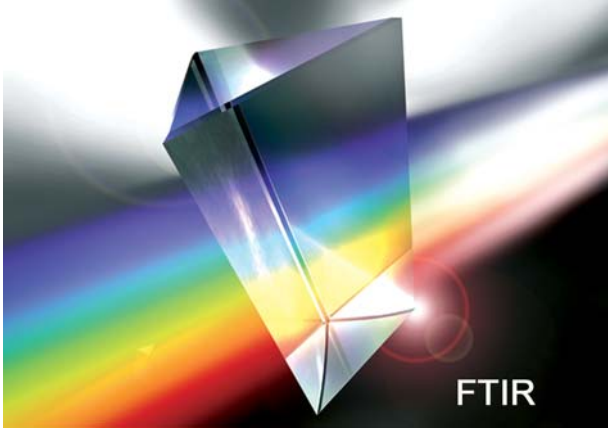
Application Note



Brominated Flame Retardants (2)

FTIR Determination of brominated Flame Retardants using an automated tool - RoHS Software -

The RoHS* Directive 2002/95/EC will restrict the use of brominated flame retardants for electrical and electronic parts starting in July 2006. The consequence is that poly brominated biphenyls like PBB and PBDE are not more allowed to be used as flame retardant ort he presence of them should not be higher than 1000 ppm, this is the limit. Here is now to introduce RoHS Software, which is a simple tool to analyze the base polymer and to analyze poly brominated substances in a polymer.

Fig. 1: Polymer elements to be analyzed, regards the presence of brominated flame retardants

Fig. 2: Elements made from black colored Polymer.

Recommendations from the RoHS Directive

The materials to be analyzed have to be homogenous. This is the minimum requirement for the use of the infrared spectroscopy. In the infrared spectroscopy a method is used which allows a surface analysis. The IR beam penetrates the sample with a depth of approx. 2 µm. To realize this a single reflection accessory is used, which makes it possible to the sample as it is, without destruction. Elements from electronic parts which were analyzed first with EDX technique were used. Minimum limit found with EDX should be a Br content of more than 5 %.

Introduction of RoHS Software

The software will guide the user through the measurement and analysis.

Procedure:

1. measure reference spectrum
2. measure sample spectrum
3. search for the base polymer
4. base polymer is identified and search for flame retardant
5. logical comparison of signals from flame retardant and ratio to main polymer
6. Conclusion
   - ●Polymer pure – OK –
   - ●Polymer + Flame retardant – NG –
   - ●much to high S/N ratio, no good contact of sample to accessory
   - ●Polymer not part of library

Abbreviation	Name of Polymer
ABS	Acrylonitrile-butadiene-styrene
ABS+PBDE	ABS containing PBDE
EVA	Ethylene-vinyl acetate copolymer
NYLON	Nylon
NYLON+PBDE	Nylon containing PBDE
PBT	Polybutylene-terephthalate
PBT+PBDE	PBT containing PBDE
PC	Polycarbonate
PC+PBDE	PC cotaiing PBDE
PC+TBBPA	PC containing TBBPA(Tetrabromobisphenol A)
PCTFE	Polychlorn-trifluoro-ethylene
PCTFE+PBDE	PCTFE containing PBDE
PE	Polyethylene
PE+PBDE	PE containing PBDE
PEEK	Polyether-ether-keton
PEEK+PBDE	PEEK containing PBDE
PEI	Polyethyerimide
PES	Polyether-sulfon
PES+PBDE	PES containing PBDE
PET	Polyethylene-terephthalate

Table 1: a selection of spectra, which is part of the RoHS library

Sample out of the palette from electrical and electronic elements

Two different materials (Fig. 1 und 2) were analyzed for the presence of brominated flame retardants..

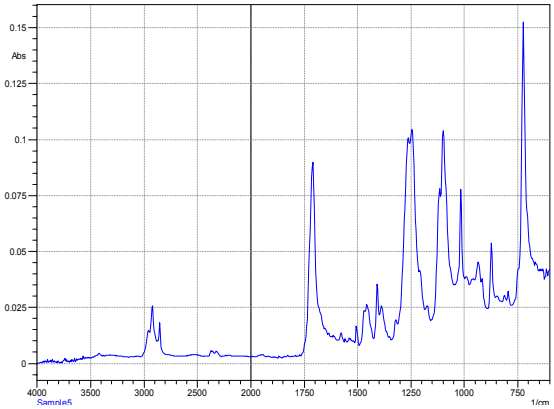


Fig. 3: IR-Spectrum of sample made from white colored polymer, RoHS Software judgment is: PBT – OK –.

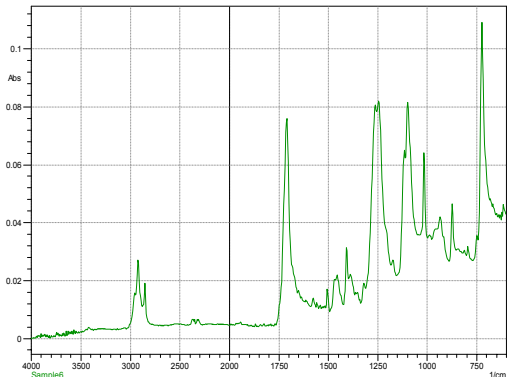


Fig. 4: IR-Spectrum of sample made from black colored polymer, RoHS Software judgment is: PBT + PBDE – NG –. (Not Good)

Both spectra show little deviations in the “Fingerprint” range. Most remarkable are the changes in the signal ratios at 1408 and 1350 cm^{-1}, the ratio limit is higher as allowed 8 see Fig. 4). Fig. 5 shows the zoom of the range of interest for both spectra (Fig. 3 and 4).

Instrumentation:

FTIR:	IRPrestige-21
Software:	IRsolution plus RoHS Software package
Library:	RoHS
Accessory:	DuraSampler II with KRS-5 Element plus Diamond Prism

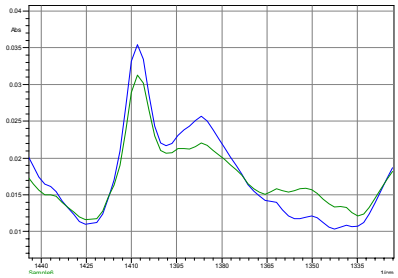


Fig. 5: Zoom from PBT and PBT + PBDE, the signal ratio from 1408 and 1350cm^{-1} is in both spectra different.