Öko-Institut e.V.
Institut für angewandte Ökologie
Institute for Applied Ecology

Fraunhofer Institut Zuverlässigkeit und Mikrointegration

Adaption to scientific and technical progress under Directive 2002/95/EC

Results previous evaluation
Exemption No. 21

"Lead and cadmium in printing inks for the application of enamels on borosilicate glass"

(Excerpt from Öko-Institut Report 2006; Annex 1 Monthly Report 3)

Öko-Institut e.V.

Freiburg Head Office
P.O. Box 50 02 40
79028 Freiburg, Germany
Street Address
Merzhauser Str. 173
D-79100 Freiburg
Tel. +49 (0)761 – 4 52 95-0
Fax +49 (0)761 – 4 52 95-88

Darmstadt Office
Rheinstraße 95
64295 Darmstadt, Germany
Tel. +49 (0)6151 – 81 91-0
Fax +49 (0)6151 – 81 91-33

Berlin Office
Novalisstraße 10
10115 Berlin, Germany
Tel. +49 (0)30 – 28 04 86-80
Fax +49 (0)30 – 28 04 86-88

- The negative environmental and health effects of substitutes are not clearly stated: "The environmental and health consequences of the use of some […] metal oxides, like BaO, are still a matter of discussion and of possible concern"[2].
- As the use of cadmium and chromium VI appears to be only of decorative/optical nature, there is no argument against a redesign of the applications without adding these substances and thus eliminating their use.
- The high amount of lead used in the mentioned applications compared to other applications in electrical and electronic equipment raises the need to give the applications discussed here a particularly close look.
- The above listed results reflect the view of the consultant which is that in our understanding there is no necessity to use lead, cadmium and/or chromium VI for the technical functionality of the evaluated applications[3].

5.6.3 Final recommendation

Due to the above mentioned results of the critical review of the request for exemption the final recommendation is not to grant an exemption for the use of lead, cadmium and chromium VI in (lead) crystal glass.

5.7 Lead bound in glass, crystal glass, lead crystal or full lead crystal - ESGA/Schott Duran (only request No. 2)

5.7.1 Requested exemption

The European Special Glass Association (ESGA) has requested an exemption for the use of lead and cadmium in enamels on borosilicate glass. The substances are contained in inks printed on borosilicate glass in certain electrical and electronic equipment (for the major part on jugs for coffee makers). The ink is used to print scales, warnings and logos on the glass.

The ink being considered a homogenous material contains between 37% and 48% PbO by weight and up to 11% CdO by weight. For the overall European market this leads to an annual consumption of 32,7 kg Pb and 2,6 kg Cd.

The lead in the ink is responsible for lowering the melting point, thus positively influencing the fusion with the glass matrix, and improving chemical resistance. As part of customer specification and consumer safety, the readability of markings has to be guaranteed for 400

[2] TNO report „Properties of lead crystal versus unleaded glass formulations (IMC-RAP-05-12372/rie), June 2005

[3] E.g. chandeliers, watches, mobile phones etc. do all work even if they are decorated with lead free crystals or non red/green crystals.

dish-washer-cycles. Cadmium together with the lead gives the enamel a good resistance against acids and alkalis as they are used in domestic cleansers Cadmium is thus also necessary to guarantee long-lasting markings.

The request for exemption is required for “lead and cadmium in printing inks for the application of enamels on borosilicate glass”.

5.7.2 Summary of justification for exemption

The applicant argues that there is no substitute for lead and/or cadmium in the ink for printing markings on borosilicate glass. There are lead-free alternatives available but these cannot guarantee the resistance to acids or alkalis. Since the relevant application is used for products that are regularly cleaned in dish-washers the applicant states that no lead-free alternative can be used. Concerning the low melting point function of lead the applicant states that there is no alternative lead-free ink that can be used on borosilicate glass.

In order to clarify potential substitutes the following questions were raised:

- Is it possible to mark the glass with etching/engraving instead of printing?
- Is it possible to use another kind of glass, which would not need lead to lower the melting point of the ink?
- Is it possible to eliminate the marking on the glass completely?

A critical review of the arguments put forward by the applicant as well as of the answers given to the questions above have lead to the following results:

- It is technically possible to substitute marked glass by non-marked glass. However, marking seems to be necessary for the functionality of the application and/or consumer safety in some cases.
- Marking the glass with etching/engraving does not seem to be technically feasible due to cracks and not sufficient resistance to acids and alkalis.
- Substituting the borosilicate glass by another kind of glass which would not require a low-melting point ink does not seem to be feasible since the glass has to meet specific characteristics (e.g. resistance to heat, fast changes between hot and cold filling) which are not met by other glass types.
- There is the theoretical possibility to use lead-free printing inks using other heavy metals such as bismuth. Trials carried out by the applicant do not seem to have lead to useful results and – again according to the applicant – it is only in the long-term (> 10 years) that a workable substitute could be developed.

5.7.3 Final recommendation

Due to the fact that the amount of lead and cadmium used in the application on borosilicate glass is relatively low compared to other applications and that substitutes fulfilling the criteria

for durability of the marking do not seem to exist we recommend granting the exemption using the following wording: “lead and cadmium in printing inks for the application of enamels on borosilicate glass”.

However, since there is an existing option through a change in design for a part of the concerned applications, we also recommend requiring from the applicant to specify the applications for which marking on the borosilicate glass is absolutely necessary for its technical functionality. In case another exemption should be requested after four years it should be limited to those applications. Furthermore, in order to ensure research of lead and cadmium free alternative enamels for the application on borosilicate glass it should be made clear that the exemption granted is only valid for a limited period of time!

5.8 Solders containing lead for specific applications – Syfer (request No. 4_a)

5.8.1 Description of requested exemption

The original wording provided by the applicant is: “Solders used for soldering to machined through hole discoidal and planar array ceramic multi layer capacitors”.

Substance

Lead

Function of the Solder

Provide the combination of a suitable melting point and ductility of 50Pb/50In or 60In/40Pb solders. The ductility of this solder avoids cracking of the ceramic layer during and after soldering due to thermal mismatch.

Specific application

Solders used for soldering to machined through hole discoidal and planar array ceramic multi layer capacitors for EMC discrete filters, filter assemblies and filtered connectors.

Precise wording

The proposed, more precise, wording for this exemption is: “Use of lead in solders containing 50 to 60 percent of indium for the soldering to machined through hole discoidal and planar array ceramic multi layer capacitors for EMC discrete filters, filter assemblies and filtered connectors“.