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. 28

"Lead bound in crystal glass as defined in Annex I (Categories 1, 2, 3 and 4) of Council Directive 69/493/EEC"

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

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

5.5.2 Summary of justification for exemption

Criteria for justification

Lead is necessary to prevent the growth of tin whiskers in particular on components where external stress aggravates the whiskering problem. Respective tests simulating the external pressure result in whisker growth on lead-free plated connectors. The observed length of 500 µm of the whiskers at the growth saturation point by far exceeds the 20 to 40 µm length of whiskers on SnPb-plated connectors under identical conditions. The conclusion is that the use of lead in finishes of FFC, FPC and their connectors is indispensable.

The applicant mentions NiPdAu and NiAu as technical alternatives. There is, however, no experience and they are commercially not available to the necessary extent, as the applicant maintains.
Additionally, the applicant brings forward that the use of gold and palladium containing finishes is impossible as the increased cost is not acceptable for many applications.

Critical review on data and information (given by applicant or other parties)

The applicant himself mentions technically viable alternatives. The cited cost reasons cannot be taken into account in this review process. As JEITA and JBCE have withdrawn their similar or identical exemption requests accepting gold as a viable substitute, the availability of the substitutes on a commercial scale should not be a blocking stone on the way to lead-free finishes on this type of applications.

5.5.3 Final recommendation

This exemption should not be granted.

From the technical point of view, viable substitutes are available for the finishes of FFC, FPC and their connectors, even if there are no long-term experiences for these alternatives. JBCE and JEITA withdrew their identical exemption requests accepting gold as a viable substitute.

5.6 Lead bound in glass, crystal glass, lead crystal or full lead crystal; Cr (VI) and Cd as colouring batch addition in glass, crystal glass, lead crystal or full lead crystal - CPIV/Swarovski (request No. 2 and No. 3)

5.6.1 Requested exemption

The Standing Committee of the European Glass Industries (CPIV) together with the company Swarovski requests an exemption for

1. *“Lead bound in glass, crystal glass, lead crystal in general,*

2. *Chromium (also in oxidation state VI) and Cadmium as colouring batch addition each form up to a content of 2% in glass, crystal glass, lead crystal or full lead crystal,*

used as decorative and/or functional part of electric or electronic equipment."

Full lead crystal glass is used in pure (colourless) or coloured form for decorative and/or functional purposes, e.g. lamps, chandeliers, decoration of mobile covers, watches etc. Lead, cadmium and chromium VI are bonded in the silicate matrix of glass. Depending on the mass of the article the amount of lead, cadmium and chromium VI varies from several milligrams (glass jewellery) to some 100 grams (chandeliers). Full lead crystal consists at least of 28% lead calculated as lead oxide (therefore > 30% lead oxide). Coloured glass (red or green) may contain up to 2% cadmium (red) or chromium (green). In absolute numbers it is estimated that about 145 t/a of lead, 0,275 t/a of Cadmium and 0,025 t/a of Chromium VI are put on the European market with products affected by the RoHS Directive.

The function of the substances in the above mentioned applications are as follows:

- Lead: decorative/optical aspects (e.g. brilliancy, high light transmission, sharp colour transition etc.) and processing aspects (e.g. thermal, mechanical and refinement properties)
- Cadmium: decorative/optical purposes (i.e. very special and pure red colours with unique light absorption)
- Chromium VI: decorative/optical purposes (green colours)

5.6.2 Summary of justification for exemption

The applicant argues that no substitute is available that would replace the substances lead, cadmium and/or chromium VI in all their properties: it is stated that no substitute has the same optical/decorative and processing properties. Substitution of the substances would lead to a loss of the characteristic optical properties. Furthermore, the applicant argues that substituting lead would lead to a need for redesigning of processes and production installations.

A critical review of the information provided by the applicant and by other parties leads to the following results:

- Lead-free substitutes seem to exist for crystal glass even though they might only fulfil some of the properties lead crystal has.
- It is not clear why lead-free substitutes cannot be used for the specific applications from a technical/scientific point of view. There is no apparent need for the applications to contain lead in view of their technical functionality
- The argument of the need to redesign production processes does not mean that a redesign is impossible. At least no founded argument has been brought forward by the applicant supporting the impossibility of redesigning production processes.

- 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.

6 Requests open for recommendation

The following section contains final recommendations for requests from set 2, set 3 and set 4 that were still open for recommendation. Furthermore it contains corrigenda of recommendations which have been subject to changes since their first publication in one of the monthly reports.

6.1 Add-on monthly report 3 section 5.6 - „Lead bound in glass, crystal glass, lead crystal or full lead crystal; Cr (VI) and Cd as colouring batch addition in glass, crystal glass, lead crystal or full lead crystal - CPIV/Swarovski (request No. 2 and No. 3)"

Upon request of the applicant, the consultant re-opened the dialogue on the recommendation given in monthly report n°3. It was agreed that the consultant would write an add-on to the existing text in report n°3 in order to better reflect the applicant's opposite view to the given recommendation.

In contrary to the consultant, the applicant argues that the functionality of a product (=electrical equipment) is NOT limited to the elementary technical function, e.g. the functionality of a chandelier is not only to spend light via the use of electricity but mainly to beautify and grace the room by the brilliancy of the crystals. Both aspects of functionality form an integral part of the product. Even if such an application could be realised with lead-, cadmium- and chromium-free alternatives, its whole functionality – according to the applicant – would not be given, since the quality of the application is directly linked to the optical and decorative properties of the crystal. The applicant states that substituting the crystals with RoHS-compliant ones would lead to a degradation in quality and thus not fulfil the needed requirements of a substitute.

A further example cited by the applicant is that a watch decorated with red crystals cannot be substituted with RoHS-compliant red crystals without crucial decrease in colour purity. This, he argues, does not fall under the term "substitution". Substitution implies equivalency.

Article 5 (1) (b) leaves room for interpretation concerning the definition of what exactly can be understood by "technically/scientifically practicable". The consultant and the applicant have diverging views on its interpretation.

6.2 Corrigendum "Solders containing lead for specific applications" – Syfer (set 1 request No. 4_a)

(Updating section 5.2 report 4 – proposed wording changed)

6.2.1 Description of requested exemption

Solders containing lead for specific applications, namely: