Reponse to 1st Questionnaire (Clarification Questionnaire) Exemption No. 7c-I (renewal request)

Exemption for „Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic matrix compound"

・**Name of applicant:**

Japan Electronics and Information Technology Industries Association (JEITA)	JEITA	Japan Electrical Manufacturers´ Association (JEMA)	JEMA
Japan Business Machine and Information System Industries Association (JBMIA)	JBMIA	Communications and Information network Association of Japan (CIAJ)	CIAJ

・**Name and contact details of responsible person for the application and responce**

Company: Murata Manufacturing Co., Ltd.	Tel.: +81 3 5469 6148
Name: Taro Hatano	E-Mail: t_hatano@murata.com
Function: Market Information Department	Address: 3-29-12; Shibuya, Shibuya-ku, Tokyo 150-0002, Japan
Company: Japan Electronics & Information Technology Industries Association	Tel.: +81 3 5218 1054
Name: Hiroyuki Ishii	E-Mail: h-ishii@jeita.or.jp
Function: Environmental Affairs Department	Address: 1-1-3,Otemachi,Chiyoda-ku, Tokyo,100-0004 Japan

Questions

Question 1)

Please be so kind to provide the PDF-documents related to your exemption request with document settings that allow copying text sections from it. This would enable us working more efficiently.

Answer:

The security-removed documents have been already provided.

Question 2)

In the 2008/2009 review of the Annex to Directive 2002/95/EC (predecessor of today's RoHS Directive 2011/65/EU), the following applications were identified for ceramics containing lead:

i .PZT ceramics

ii.Dielectric ceramics

iii.PTC ceramics

iv.Thickfilm technology

Is the above list of applications complete and still valid? If not, please add other applications of lead in ceramics and in glass

Answer:

Lead-containing ceramic and glass, exempted by the RoHS Directive, has a wide variety of applications. Moreover there are many cases in which it may simultaneously correspond to different applications. Therefore, it is impossible to provide a complete exhaustive list including all applications.

That is to say that, the list at the time of the revision of the former RoHS Directive exemption provisions in 2008/2009, did not completely cover all applications which were/are necessary then and now, of lead-containing ceramic and glass, exempted by the RoHS Directive. However, this list is useful as a typical illustrative example of lead-containing ceramic and glass applications, exempted by the RoHS Directive.

We provide for your reference a version of the list revised from a scientific and technological perspective for better usability. Please take notice that this list is not obviously a complete (exhaustive) list of applications.

i Piezoelectric ceramic

ii Dielectric ceramic

iii Semiconductor ceramic

iv Thick film technology

(Note 1) PZT is a term utilized for expressing a lead zirconate titanate composition and does not indicate any particular application per se. PTZ-using ceramic is utilized in all applications listed from i to iii above.

(Note 2) PTC ceramic is included in a part of semiconductor ceramic.

Question 3)

Please explain for each of the above applications, including additional applications you might have identified:

a) The research you have undertaken since 2008 to find lead-free alternatives;

b) The results and status of lead-free alternatives;

Answer:

As stated in the previous item, as it is impossible to provide a list covering all lead-containing ceramic and glass applications, we presented the research background, results and current status in Annex 1 - Ceramic and Annex 2 - Glass of our application request form. As the reply to your question is described in that document, please refer to it.

a) For your reference, we provide examples of research background, results and current status for the applications shown in Answer 2).

i. Piezoelectric ceramic

There are examples of research on substitution by “lead-free” ceramic using alkali niobate-type materials, etc. for very limited particular applications. Please see the reference documents below for details.

As also stated in the reference documents*, electrical properties (piezoelectricity) of “lead-free” ceramic are inferior when compared with those of lead-containing ceramic and the former cannot stably bring out the (necessary) properties over a wide temperature range.

Moreover, it is not possible, in a general manner, to stably achieve the properties obtained under laboratory conditions in a mass production scale.

As shown above, there are numerous issues which still must be solved in order to achieve mass production of products in practice, and adding to that, even if mass production technology is perfected the properties necessary for substituting lead-containing ceramic have not been obtained for almost all of the applications.

*Jing-Feng Li, Ke Wang, Fang-Yuan Zhu, Li-Qian Cheng, and Fang-Zhou Yao, “(K, Na)NbO3-Based Lead-Free Piezoceramics: Fundamental Aspects, Processing Technologies, and Remaining Challenges”, J. Am. Ceram. Soc., 1–20 (2013)

ii Dielectric ceramic

When using “lead-free” ceramic, the conditions for which it can be stably used are limited, as energy loss and electrostrictive properties during use are large.

It was possible to find out substitution technologies for low-voltage discrete capacitors (rated voltages of less than 125V AC or 250V DC) and terminate them (exemption 7(c)-III), however for the other applications there is still no technical perspective at all for eliminating lead.

Although applications of dielectric ceramic are also included in the scope of 7(c)-I, typical illustrative examples fall under 7(c)-II, so please refer to the application form of 7(c)-II together with this one.

iii. Semiconductor ceramic

Semiconductor ceramic shows characteristics of resistivity (values) changing according to temperature changes, and in order to apply these characteristics to electrical and electronic components, it is necessary to control the resistivity change points in the desired temperatures.

Lead is added to semiconductor ceramic with the purpose of exerting this type of control.

Ceramic constituted of a solid solution of sodium and bismuth-added material and barium titanate have been proposed by research institutions as substitute material, however as reliability has not been ensured and mass production technology has not been settled, it could not be put into practical use.

iv. Thick film technology

Thick film technology used for forming electrical and electronic components is a technology that forms multi-functional articles by molding materials such as glass, ceramic, metals, etc. through the use of printing technology and sintering at high temperatures.

In thick film technology, for example, by using a material compounded with glass, it becomes possible to electrically/mechanically bond different materials such as ceramic and metals together with glass.

If we eliminate lead from the glass used in thick film technology, the required properties for electrical and electronic equipment (electrical properties, stability and mechanical strength, etc.) become insufficient and consequently there is absolutely no technical perspective for removing lead.

For substitution technology of lead-containing glass used in thick film technology (applications), please refer to Annex2-glass of our application form where we provide details on research background.

b) As shown in the research background explained in a) (including the typical examples of applications shown in the reply to Question 2), there is no technical perspective at all for substitution of the lead-containing ceramic and glass subject to RoHS exemption 7(c)-I by “lead-free” alternatives.

Please carefully notice that these replies are mere illustrative examples and do not completely cover all research background and results of lead-containing ceramic and glass in electronic components.

Question 4)

In the 2008/2009 review, the total amount of lead used in the applications listed in question 0 excluding thickfilm technology applications was calculated with around 910 t in total, from which around 270 t were estimated to enter the EU.

In your current exemption request, you calculated 830 t of lead use in ceramics, thickfilm technology AND in glass, from which 250 t are estimated to enter the EU. You claim further on that since 2007 the total use of lead has been reduced to 78 t for ceramics, thickfilm technology and glass.

a) Please explain the considerable differences between the amounts of lead you indicated in the 2008/2009 review and the 2007 amounts of lead use in your current exemption request.

b) Please provide representative examples for each of the applications listed in question 0 and for lead in glass in order to substantiate this enormous reduction of lead use despite of growing numbers of components.

Answer:

a) As the data provided last time was tabulated only for the particular applications mentioned in the list, the grand total was inadequate. This time, we broadened the tabulation scope as best as possible to all (applications) known to us.

For the applicable scope of 7(c)-II which had been included in the tabulation last time, this time we presented it in the tabulation result of the application request form for 7(c)-II, thus omitting it from the application request form for 7(c)-I.

Due to the above reasons, differences occurred in the tabulation results.

b) We provide a comprehensive reply concerning lead-containing ceramic and glass in electronic components for this question in Annex 3 of our application request form. Please refer to it.

The improvement of the functionality and smart functions as well as network integration of electrical and electronic equipment has largely contributed to a sound, cultural life of the European citizens and the number of sectors in which electrical and electronic equipment is utilized has vastly enlarged in 2015 when compared to 2007. Nonetheless, as individual functions of conventional digital cameras, telephones and net PCs, etc., have been multi-functionally integrated within compact lightweight smart apparatuses through the substitution of relatively large-sized single equipment groups by one item thin-type compact smart equipment having several functions, etc. it is possible to restrain the amount of electrical and electronic equipment put on the market as well as the number of electrical and electronic component pieces built in the equipment.

Furthermore, by planning on design, better functional efficiency and cost rationalization, the lead amount used in electrical and electronic equipment on the whole has been restrained with the reduction of the number of component pieces within single equipment .

Adding to these efforts, the progress of the downsizing of electrical and electronic components constituting equipment has been advaced with the promotion of sophisticated multilayer techniques applying thick layer technology in order to cope with the demands of miniaturization of electrical and electronic equipment as well as through the contribution of low voltage/small current trends in electrical circuits for meeting high-frequency compatibility and power-saving demands.

As the concentration amount (rate) of lead necessary to bring out the functionality of electrical and electronic components does not change, it is possible to reduce the use amount of lead proportionally to the downsizing of the components.

As a result, as stated in the table in Annex3, the average value of “Lead use amount per Piece unit” has changed from 0.75mg to 0.25mg (almost 1/3 of the previous figure), and this has enabled the reduction in the use amount of lead.