Standard application format for RoHS exemption requests on the basis of Article 5(8) Directive 2011/65/EU

Final

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Authors:

Dr. Otmar Deubzer

Carl-Otto Gensch

Stéphanie Zangl

Katja Moch

Yifaat Baron

Öko-Institut e.V.
Freiburg Head Office
P.O. Box 17 71
79017 Freiburg, Germany
Street Address
Merzhauser Str. 173
79100 Freiburg
Tel. +49 (0) 761 – 4 52 95-0
Fax +49 (0) 761 – 4 52 95-288

Darmstadt Office
Rheinstr. 95
64295 Darmstadt, Germany
Tel. +49 (0) 6151 – 81 91-0
Fax +49 (0) 6151 – 81 91-133

Berlin Office
Schicklerstr. 5-7
10179 Berlin, Germany
Tel. +49 (0) 30 – 40 50 85-0
Fax +49 (0) 30 – 40 50 85-388

Exemption Request Form

Date of submission: January 15, 2015

1. Name and contact details

1) Name and contact details of applicant:

Company:	Sensata Technologies	Tel.:	+31546879564
Name:	Albert van der Kuij	E-Mail:	a-vdkuij@sensata.com
Function:	Business Development & Standards Engineer	Address:	Kolthofsingel 8, 7602 EM Almelo

2) Name and contact details of responsible person for this application (if different from above):

Company:	_____	Tel.:	_____
Name:	_____	E-Mail:	_____
Function:	_____	Address:	_____

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2. Reason for application:

Please indicate where relevant:

☐ Request for new exemption in:

☐ Request for amendment of existing exemption in

☒ Request for extension of existing exemption in: Annex III 7(c)-I Electrical and electronic components containing lead in a glass or ceramic other than dielectrical ceramic in capacitors, eg. piezoelectronic devices, or in a glass or ceramic matrix compound

☐ Request for deletion of existing exemption in:

☐ Provision of information referring to an existing specific exemption in:

☐ Annex III ☐ Annex IV

No. of exemption in Annex III or IV where applicable: _____

Proposed or existing wording: _____

Duration where applicable: _____

☐ Other: _____

3. Summary of the exemption request / revocation request

Application of Lead in glass is needed to obtain good bonding, sealing and encapsulation properties by glass in for example:

- bonding ceramic to ceramic to form a pressure sensing element
- bonding diverse sensing elements on steel including sealing
- Lead contained in low melting type glass for encapsulation of electronic components, like thick film paste for hybrid integrated circuits, resistors, capacitors,…etc…

Lead is also used in ceramic PTC elements, status of knowledge of alternatives is present at our suppliers.
The use of Lead in bonding glasses result in lowering the softening point, lowering the viscosity, matching the coefficient of thermal expansion (CTE), improve affinity and strengthen environmental resistance of parts to be bonded, sealed and/or encapsulated.
Alternative lead free glasses meeting the requirement of matching coefficient of thermal expansion of parts to be bonded are available, but these materials do not fulfill other requirements. Experiments on alternative materials are conducted but with marginal results. The material match and process profiles are not fulfilling the requirements. Lead glasses are superior in the combination of characteristics versus for example Zn, P-S and Na-Al-P-B glasses.
Sensata sensor applications are currently predominantly used in the automotive segment under the ELV directive (exempt 10a). Also here it is indicated that there are not yet suitable alternatives available. There is a growing need in for example household and industrial applications for mission critical sensors as made by Sensata, to make applications more safe, more energy efficient and less emissive.

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4. Technical description of the exemption request / revocation request

(A) Description of the concerned application:

1. To which EEE is the exemption request/information relevant?

Name of applications or products:
Sensors for measuring for example pressure and temperature (with objective at application level to improve safety, increase energy efficiency, reduce emissions …etc…) of media used in several different applications:

- Example 1: bonding ceramic on ceramic to form a pressure sensing element
- Example 2: bonding sensing elements on steel
- Example 3: encapsulation of resistors and capacitors
- Other like: Varistors, Bridge rectifying devices. Power transistors, Power thyristors, Quartz oscillators, Diodes, Thermistors, VFD Displays

a. List of relevant categories: (mark more than one where applicable)

☒ 1 ☒ 7
☒ 2 ☒ 8
☒ 3 ☒ 9
☒ 4 ☒ 10
☒ 5 ☒ 11
☒ 6

b. Please specify if application is in use in other categories to which the exemption request does not refer: NA

c. Please specify for equipment of category 8 and 9:

The requested exemption will be applied in

☐ monitoring and control instruments in industry

☐ in-vitro diagnostics

☐ other medical devices or other monitoring and control instruments than those in industry

2. Which of the six substances is in use in the application/product?

(Indicate more than one where applicable)

☒ Pb ☐ Cd ☐ Hg ☐ Cr-VI ☐ PBB ☐ PBDE

3. Function of the substance: _____

- Lower the softening point
  Leaded glass has a low softening temperature. The glass is used to bond for example silicon strain gages with aluminum bond pads on stainless steel diaphragm. The firing temperature (at which the silicon is bonded to the stainless steel) must not exceed the (eutectic) temperature of the aluminum, potentially causing junction spiking and other reliability issues in the aluminum on silicon. Firing temperature is normally in the 850 C range.
- Lower the viscosity
  Leaded glass has a low viscosity needed to flow well during the bonding process. Bad flow potentially causes pin holes and other (surface) imperfections which makes the glass sensitive to cracks and other mechanical damages when subjected to mechanical stresses which will occur during normal operation (= pressure exerted on steel and ceramic diaphragm). Cracks cause unacceptable sensor drift and potential sensor failure. Lead-free glasses have much higher viscosity (in the order of 100).
- Match coefficient of thermal expansion of parts to be bonded
  The CTE of the glass should be within a specific window and compatible with stainless steel and alumina.
  Too low values cause a too high compressive stress in the glass,

Too high values can cause tensile stress.
Both may result in glass cracks and, consequently, sensor failure.

- Improve Affinity - To guarantee a sufficient adhesion between ceramic element and metal electrode or between semiconductor device and glass
- Increase the resistance versus environmental conditions

4. Content of substance in homogeneous material (%weight):
   Bonding glass for pressure sensors upto 75% wt% Lead monoxide concentration
   Borosilicate glass / Electrodes / 1 to 57 wt% lead concentration
   Borosilicate glass / Resistor binder (adhesion assurance for ceramic base materials) / 3 to 30 wt% lead concentration
   Ruthenium lead oxide / Resistor / 56.9 wt% lead concentration

5. Amount of substance entering the EU market annually through application for which the exemption is requested: For Sensata predominantly in the automotive segment, but increasing in for example household and industrial segments due to the growing need of making applications more safe, more energy efficient and less emissive.
   Please supply information and calculations to support stated figure.

6. Name of material/component: Lead contained in glass

7. Environmental Assessment: _____
   LCA: ☐ Yes
   ☒ No

(B) In which material and/or component is the RoHS-regulated substance used, for which you request the exemption or its revocation? What is the function of this material or component?

Lead contained in glass as explained under 4A3 to lower the softening point, to lower the viscosity, match the CTE, improve affinity and increase environmental resistance.

(C) What are the particular characteristics and functions of the RoHS-regulated substance that require its use in this material or component?

See detailed explanation 4(A)3.

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5. Information on Possible preparation for reuse or recycling of waste from EEE and on provisions for appropriate treatment of waste

1) Please indicate if a closed loop system exist for EEE waste of application exists and provide information of its characteristics (method of collection to ensure closed loop, method of treatment, etc.)

NA, too hard to disassemble for recycling

2) Please indicate where relevant:

☐ Article is collected and sent without dismantling for recycling
☐ Article is collected and completely refurbished for reuse
☐ Article is collected and dismantled:
  ☐ The following parts are refurbished for use as spare parts: _____
  ☐ The following parts are subsequently recycled: _____
☒ Article cannot be recycled and is therefore:
  ☐ Sent for energy return
  ☒ Landfilled

3) Please provide information concerning the amount (weight) of RoHS substance present in EEE waste accumulates per annum:

☐ In articles which are refurbished _____
☐ In articles which are recycled _____
☐ In articles which are sent for energy return _____
☒ In articles which are landfilled See item 4(A)5 of this form

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6. Analysis of possible alternative substances

(A) Please provide information if possible alternative applications or alternatives for use of RoHS substances in application exist. Please elaborate analysis on a life-cycle basis, including where available information about independent research, peer-review studies development activities undertaken.

There are no alternatives available combining the characteristics needed to make good bonding, sealing and encapsulation (see also below overview).

However, any compositions can not satisfy the characteristics as listed below.

Characteristics	Pb glass	Zn glass	P-Sn glass	Na-Al-P-B
Affinity	Good	Not good	Not good	Good
Low melting point	Yes	No	Yes	Yes
Coefficient to thermal expansion	Good	Good	Good	Not good
Weather resistance	Good	Good	Not good	Not good

(B) Please provide information and data to establish reliability of possible substitutes of application and of RoHS materials in application

NA

7. Proposed actions to develop possible substitutes

(A) Please provide information if actions have been taken to develop further possible alternatives for the application or alternatives for RoHS substances in the application.

Alternatives are looked for within a CLEPA (Association for automotive suppliers) workgroup

(B) Please elaborate what stages are necessary for establishment of possible substitute and respective timeframe needed for completion of such stages.

Glasses should be developed by glass frit suppliers with the suitable combination of characteristics.

8. Justification according to Article 5(1)(a):

(A) Links to REACH: (substance + substitute)

1) Do any of the following provisions apply to the application described under (A) and (C)?

- ☒ Authorisation
  - ☒ SVHC
  - ☒ Candidate list
  - ☐ Proposal inclusion Annex XIV
  - ☐ Annex XIV
- ☐ Restriction
  - ☐ Annex XVII
  - ☐ Registry of intrusions
- ☐ Registration

2) Provide REACH-relevant information received through the supply chain.

Name of document: Not needed w/i limits

(B) Elimination/substitution:

1. Can the substance named under 4(A)2 be eliminated?
   - ☐ Yes. Consequences? _____
   - ☒ No. Justification: Lead offer specific characteristics to glasses needed to be used in applications.
2. Can the substance named under 4(A)2 be substituted?
   - ☐ Yes.
     - ☐ Design changes:
     - ☐ Other materials:
     - ☐ Other substance:
   - ☒ No.

     Justification: There are no alternatives available yet that do offer the same set of needed characteristics.
3. Give details on the reliability of substitutes (technical data + information):_____

4. Describe environmental assessment of substance from 4(A)2 and possible substitutes with regard to
    1) Environmental impacts: _____
    2) Health impacts: Lead monoxide (CAS 1317-36-8) Toxic for reproduction (Article 57 c)
    3) Consumer safety impacts: _____

⇨ Do impacts of substitution outweigh benefits thereof?
Please provide third-party verified assessment on this: _____

(C) Availability of substitutes:

a) Describe supply sources for substitutes: several glass frit suppliers
b) Have you encountered problems with the availability? Describe: The needed combination of softening, viscosity and coefficient of thermal expansion cannot be obtained in glass without lead oxide.
c) Do you consider the price of the substitute to be a problem for the availability?
☐ Yes ☒ No
d) What conditions need to be fulfilled to ensure the availability? A suitable alternative should be developed by glass frit suppliers having the needed combination of characteristics as described before applicable for a wide variation of applications.

(D) Socio-economic impact of substitution:

⇨ What kind of economic effects do you consider related to substitution?

☐ Increase in direct production costs
☐ Increase in fixed costs
☐ Increase in overhead
☐ Possible social impacts within the EU
☐ Possible social impacts external to the EU
☒ Other: Do not know yet

⇨ Provide sufficient evidence (third-party verified) to support your statement: _____

9. Other relevant information

Please provide additional relevant information to further establish the necessity of your request:

NA

10. Information that should be regarded as proprietary

Please state clearly whether any of the above information should be regarded to as proprietary information. If so, please provide verifiable justification:

NA