Exemption Request Form

Date of submission: 17. January 2020

1. Name and contact details

1) Name and contact details of applicant:

Company:	Japan Business Council in Europe	Tel.:	+32 2 286 53 30
Name:	Takuro Koide	E-Mail:	koide@jbce.org info@jbce.org
Function:	Policy Manager	Address:	Rue de la Loi 82, 1040 Brussels, Belgium

This exemption application is submitted with the endorsement of the business associations listed below:

Japan Analytical Instruments Manufacturers' Association (JAIMA)	Japan Electric Measuring Instruments Manufacturers' Association (JEMIMA)

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
- ☑ 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: Annex IV-3, Annex IV-39

Proposed or existing wording:

Annex IV has two kinds of exemptions for micro-channel plate, one is exemption no.3 and the other is no.39. No.3 is an exemption for detecting ionising radiation, No.39 for detecting electrons, ions or other forms of radiation(1). The original exemption list of Annex IV included only No.3 but it was not broad enough in scope to cover all of MCP applications. Therefore, JBCE submitted a request for a new exemption of MCP in 2012 and as a result, exemption No.39 was granted and published after its consultation. This is the reason why Annex IV has two kinds of MCP exemptions. As the MCP used for applications of both exemptions 3 and 39 are identical, JBCE believe that only one exemption is needed to cover all uses.

The result of the exemption consultation for MCP applications, the wording of No.39 excluded certain specifications which other detectors could be used as alternatives. Details of alternatives, see answer to 6(A). MCPs covering No.3 and No.39 are the same products, thus JBCE proposes merging No.3 and No.39 in this request.

To summarise,

・Request for amendment of Annex IV-39

・Request for extension of scope of Annex IV-39

・Request for deletion of Annex IV-3 if included in Annex IV-39

Proposed wording for 39 with additional wording underlined ;

Lead in micro-channel plates (MCPs) used in equipment where at least one of the following properties is present:

(a) a compact size of the detector for <u>ionising radiations</u>, electrons, or ions, where the space for the detector is limited to a maximum of 3 mm/MCP (detector thickness + space for installation of the MCP), a maximum of 6 mm in total, and an alternative design yielding more space for the detector is scientifically and technically impracticable;

(b) a two-dimensional spatial resolution for detecting <u>ionising radiations</u>, electrons, or ions, where at least one of the following applies:

(i) a response time shorter than 25 ns

(ii) a sample detection area larger than 149 mm^2

(1) Ultraviolet; refer table13-3(page 154) and table 13-4(page 161) in Assistance to the Commission on Technological Socio-Economic and Cost-Benefit Assessment Related to Exemptions from the Substance Restrictions in Electrical and Electronic Equipment (RoHS Directive) Final Report(2013).

(iii) a multiplication factor larger than 1.3×10^3

(c) a response time shorter than 5 ns for detecting ionising radiations, electrons, or ions

(d) a sample detection area larger than 314 mm^2 for detecting ionising radiations, electrons, or ions

(e) a multiplication factor larger than 4.0×10^7 for detecting UV, ionising radiations, electrons, or ions

Duration where applicable: Until the end of 2026.

☐ Other: _____

3. Summary of the exemption request / revocation request

This exemption is required to enable the use of lead contained in micro-channel plates (MCP), which are devices that detect ionizing radiation, electrons, ions or Ultraviolet light. Microchannel plates are installed in equipment such as mass spectrometry, semiconductor inspection, surface analysis, etc., and the equipment are used in various fields such as medicine, measurement, analysis, and academic research.

Lead-free MCPs are currently in the stage of trial production / testing. JBCE predicts that the MCPs mentioned above can be replaced by lead-free MCPs by the end of 2026. We apply for renewal of the exemptions 3 and 39 for MCP to be valid until that time.

---

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: Micro-channel Plates

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: _____

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: detection of UV rays, electrons, ions and ionising radiation such as X-rays and gamma rays in a vacuum, and the amplification of the detected signals

4. Content of substance in homogeneous material (%weight): 45-50 wt%

5. Amount of substance entering the EU market annually through application for which the exemption is requested: 2.5kg
   Please supply information and calculations to support stated figure.
   JBCE provided data of the total amount of lead used in micro-channel plates at the previous consultation, and the report(2) shows it was 2.5kg per year from Hamamatsu photonics to EU market. The amount of lead could be different because sales fluctuate every year, but there are no big annual differences so it is reasonable to expect the same quantity this time.

6. Name of material/component: lead 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?

MCP consist of millions of glass capillaries lined up in two dimensions. The capillaries (channels) have diameters ranging from a few to a few tens of micrometres. The capillaries work as an electron multiplier. Figure 1 shows the operating principle of an MCP.

(2) 13.0 Exemption Request No. 10 "Lead in micro-channel plates", Assistance to the Commission on Technological Socio-Economic and Cost-Benefit Assessment Related to Exemptions from the Substance Restrictions in Electrical and Electronic Equipment (RoHS Directive) Final Report(2013)

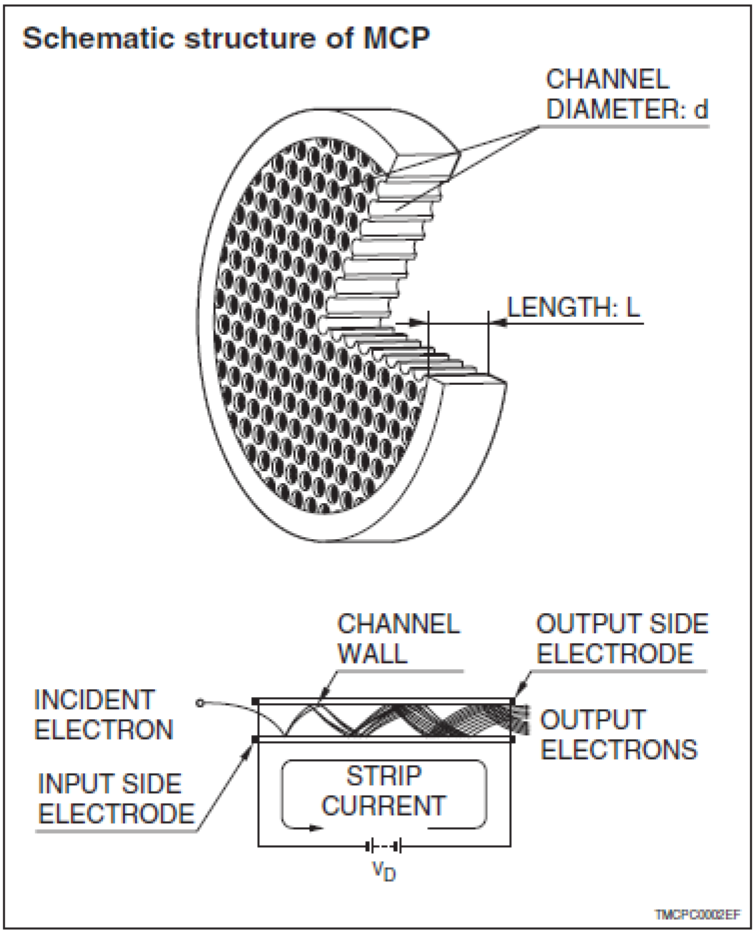


Figure 1: Operating principle of MCP

The voltage V_D between the input and output sides of the MCP generates a potential gradient along the channel. Multiple secondary electrons are emitted when an electron enters a channel from the input side and strikes its inner wall. The potential gradient accelerates these secondary electrons to draw parabolic trajectories that are determined by their initial velocities. They then strike the opposite wall in the channel causing further secondary electrons to be emitted. The electrons in this way travel towards the output end while striking the inner wall of the channel repeatedly. As a result, an exponentially increased large number of electrons emerge from the output side.

MCPs detect ionizing radiation, ions, electrons and UV light, then amplifies the detected signals. This kind of amplification is essential for, among others, mass spectrometers, semiconductor inspection equipment, and surface analysis equipment. The following table[3] shows major applications of MCP, but is not an

(3) Table 13-1: Applications of MCP based on other inputs than electromagnetic radiation, Assistance to the Commission on Technological Socio-Economic and Cost-Benefit Assessment Related to Exemptions from the Substance Restrictions in Electrical and Electronic Equipment (RoHS Directive) Final Report

exhaustive list.

Examples of the Equipment for MCP Applications

Illustrative Field,etc	Illustrative Application	Input
Mass spectroscopy	Time-of-flight mass spectroscopy (TOF-MS) (MALDI)	Ion
	Time-of-flight mass spectroscopy (TOF-MS) (LC-MS)	Ion
	Time-of-flight mass spectroscopy (TOF-MS) (GC-MS)	Ion
	Quadrupole mass spectroscopy (Q-MS)	Ion
	Double focusing mass spectroscopy (Sector-MS)	Ion
	Gas or liquidchromatographic mass spectroscopy (GC/LC-MS)	Ion
	Inductive-coupled plasma mass spectroscopy (ICP-MS)	Ion
	Secondary ion mass spectroscopy (SIMS)	Ion
Semiconductor inspection	Scanning electron microscope (SEM)	Electron
	Scanning ion microscope (SIM)	Electron, Ion
	Electron beam measuring system (EBMS)	Electron
	Electron or ion beam lithography	Electron, Ion
	Mask aligner	Electron
	FIB system	Electron, Ion
Surface analysis	Auger electron spectroscopy (AES)	Electron
	Ion scattering spectroscopy (ISS)	Ion
	Electron spectroscopy for chemical analysis (ESCA)	Electron
	Rutherford backscattering spectroscopy (RBS)	Ion
	Vacuum UV spectroscopy (VUVS)	UV
	Soft X-ray spectroscopy (SXS)	X-ray*
	Reflection medium energy electron diffraction (RMEED)	Electron
	Low energy electron diffraction (LEED)	Electron
	Field ion microscope (FIM)	Ion
	Tranmission electron microscope (TEM)	Electron
	Soft X-ray microscope (SXM)	X-ray*
	Positron detector	Positron

*Note: The applications of X-ray input are covered by the exemption "1. Lead, cadmium and mercury in detectors for ionising radiation." in Annex IV of 2011/65/EU

Table 1: Examples of Equipment for MCP applications

MCPs are applied in a wide variety of devices, and are one of the key components to advance the scientific world as a detector for various analytical instruments. MCPs are installed into MCP-PMT (photomultiplier tubes) and image intensifiers (See Figure 3). End use of above applications are not known in great detail by the manufacturers of the MCP. However, for guidance it is known that MCP are used in many of medical, analysis and measuring fields, playing a critical role it their operation. For example, mass spectroscopy equipment[(4)] is used to analyse for Air pollution, Water and Soil, Persistent organic Pollutants, Food Additives and Sweeteners, Veterinary Drugs and others. Another example where MCP are used for surface analysis equipment[(5)] which is used for basic research in biology, polymers, ceramics, semiconductors, metals, etc.

(4) Example of mass spectroscopy equipment: https://www.shimadzu.com/an/lcms/9030/index.html

(5) Example of surface analysis equipment: https://www.jeol.co.jp/en/products/list_tem.html

Figure 2: Examples of MCP

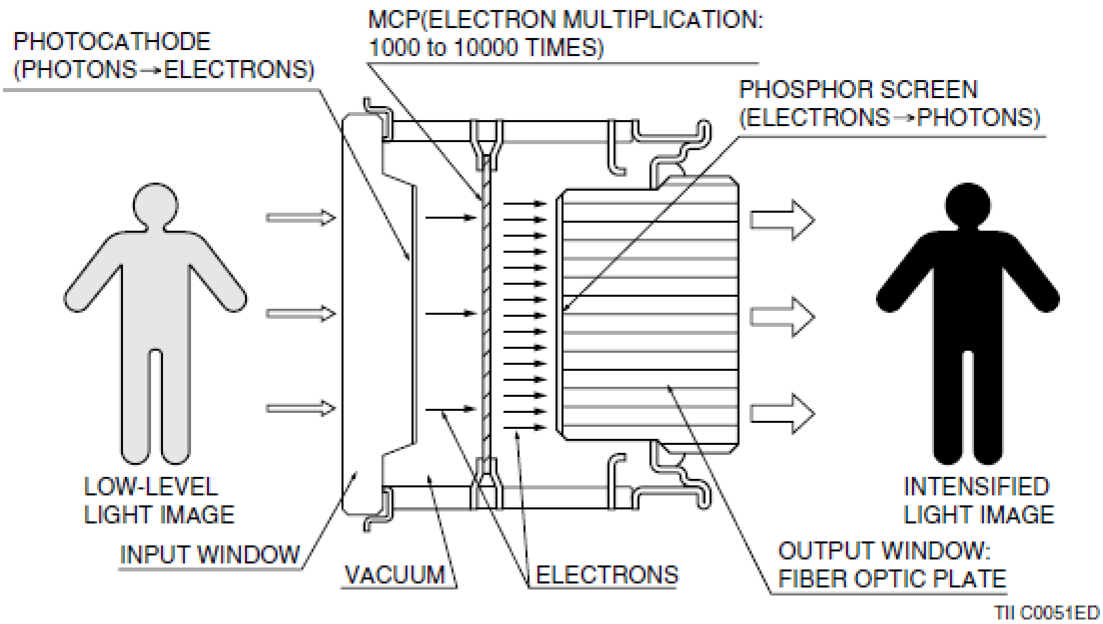


Figure 3: Structure and operating principle of image intensifier

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

The MCP has millions of glass capillary lined up in two dimensions with each capillary (channel) at a diameter of a few to few tens micrometer which works as an electron multiplier. These glass capillaries are produced by softening a glass tube with heat and drawing several times into a diameter of a few to few tens micrometer. This process is only possible from the characteristics of glass at the manufacturing temperature, especially its softness and extensibility, thus is not possible with materials other than glass at this moment. Furthermore, lead gives the conductivity to the glass that is essential to obtain the electron multiplication for each channel, therefore adding PbO and its reduction treatment become necessary to produce a semiconducting surface layer.

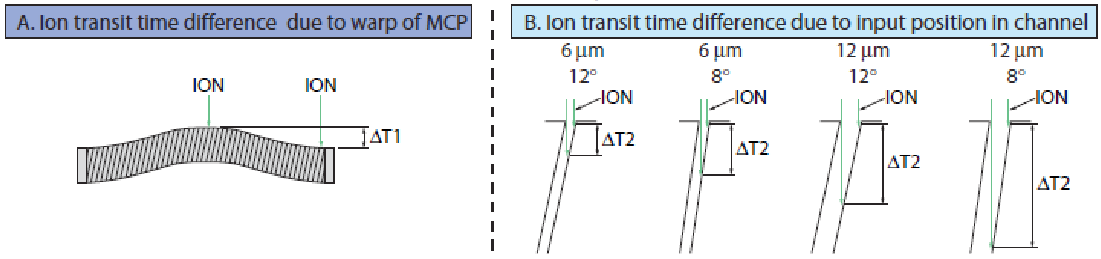
MCPs can have several size of channel diameters, but particularly small diameter is essential. Image resolution depends on number of glass capillary, the larger the number of capillaries in the MCP, the higher is the image resolution provided.

One application where this is particularly important, but is required for other applications also is in time of flight mass spectrometer (TOF-MS) where high spatial resolution is required. Transit times of charged ions are different between small diameter and large diameter, small time jitter (detector jitter is a result of differing transit times for ions, which causes peak broadening and so inferior accuracy / sensitivity) is necessary for TOF-MS. It takes longer if ions input into large diameter channel, and therefore wouldn't meet requirement of high responce for TOF-MS if small channel size would not be able to be manufactured.

Moreover, small capillary diameters enable MCP to have a larger number of channels in the same area, then its linearity is improved. Figure 4 shows different time jitters between 6 micrometer diameter channel and 12 micrometer; showing the 12 micrometer diameter channel takes longer ⊿T2 than 6 micrometer. Larger time jitter result in peak broadening so that ions of similar mass cannot be distinguished.

Small time jitter from Flat MCP

There are two major factors creating time jitter. One is a warp of MCP which has larger effect on the time jitter. The other is the channel diameter and bias angle combination.



TIME JITTER COMPARISON

Factor	A	Warp (µm)	20				200			
	B	Channel Dia. (µm)	6		12		6		12	
		Bias angle	12 °	8 °	12 °	8 °	12 °	8 °	12 °	8 °
Jitter	A	$\Delta T1$ (ns)	0.5				4.6			
	B	$\Delta T2$ (ns)	0.7	1.0	1.3	2.0	0.7	1.0	1.3	2.0
Sum (ns)			0.86	1.12	1.39	2.06	4.65	4.71	4.78	5.02

* Ion mass: 1000 u., Ion acceleration voltage: 10 kV, calculation data

Figure 4: Time jitter

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.)

No closed loops exist.

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 2.5kg

---

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

As described in section 4(C), lead glass, which contains PbO, is essential to produce MCP. The PbO is chemically stable material in the glass and is not replaceable with other material. It has been used as the glass material of crafts glass as "crystal glass" than in the past. By adding PbO, the melting temperature of the glass is kept low and molding is easier compared to other glasses. These features are required for fine processing structures like MCP.

Quartz, which is another glass material (which does not contain lead), is unable to be used to manufacture MCP because it requires a short time treatment at high temperatures which would not allow the formation for fine capillaries required for MCP. (See table2)

Properties	Quartz glass	Lead glass
Softening temperature	1580 °C	600 °C
Thermal expansion coefficient	0.55×10^{-6}	9.0×10^{-6}

Table 2: Typical properties of Quartz glass and Lead glass

Atomic layer deposition (ALD) for coating channels with a conductive layer has been considered as a potential alternative method to manufacture lead-free MCPs. ALD is a thin-film deposition technique based on the sequential use of gas phase chemical process; it is a subclass of chemical vapour deposition. The link below is a footage which shows basic form of ALD.
https://www.youtube.com/watch?v=uCK7-lw4iHM
The secondary emission electron layer applied in the glass micro-channels (pores) by atomic layer deposition takes over the function of generating electrons from ionizing inputs. Neither leaded glass nor any other RoHS-restricted substance is required. Figure 5 give an overview on the production and the construction of an ALD-MCP.

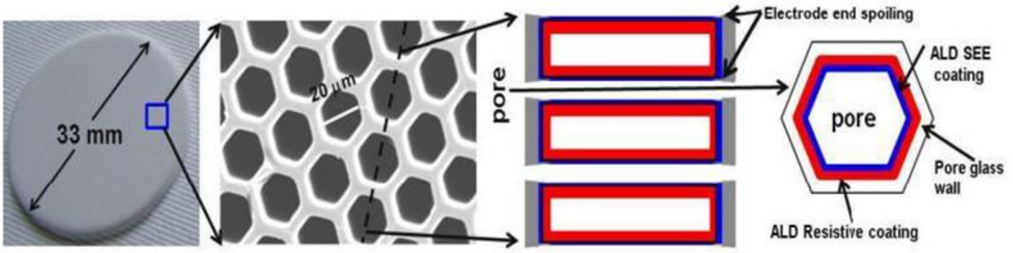


Figure 5: ALD-MCP

In this technology, US researcher Ali Mane published a study report as alternative technology of lead-MCP. However, it was concluded at the previous consultation report[2] that ALD-MCP was not able to be considered an alternative technology because channel diameter or detecting inputs are limited. Their Pb free glass capillary which was successfully coated was only 20 micrometer diameter which didn't meet requirement for our applications. Their project to develop MCP by ALD was ended in 2012. However, they didn't develop MCPs which have small diameter channel because the purpose of their project was to make larger MCP.

They have released papers[6] about prototype product which use this technology since 2012 but no other developments in this technology have been reported, not described development of small diameters channel.

The previous consultation report[2] also mentioned devices that detect electrons, ions, UV, or ionising radiations other than MCP. (See table 3)

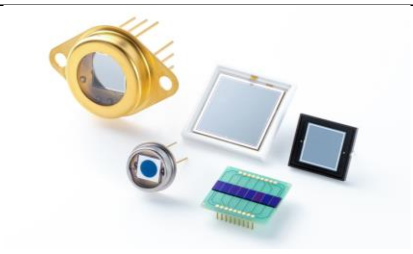
EMT: Electron Multiplier Tube, also called Secondary Electron Multiplier (SEM)	
CEM: Channel Electron Multiplier, Channeltron	
PD: Photodiode	
PD-EBCCD: PD-electron bombarded charge-coupled device	
PMT: Photomultiplier Tube	

Table 3: Alternative Detectors

Table 4 shows potential alternative detectors that can be used for different forms

[6] Atomic layer deposition of alternative glass microchannel plates Journal of Vacuum Science & Technology A 34, 01A128 (2016); https://doi.org/10.1116/1.4936231

of input radiation but would not meet the size requirements MCP or are limited in their ability to detect certain types, as discussed in more detail below.

Type of input	Detector
Electrons	• MCP • EMT: Electron Multiplier Tube, also called Secondary Electron Multiplier (SEM) • CEM: Channel Electron Multiplier, Channeltron • PD: Photodiode, requires more than 5 keV input energy, therefore not suitable for detection of low energy inputs • PD-EBCCD: PD-electron bombarded charge-coupled device
Ions	• MCP • EMT: Detects and multiplies secondary electrons emitted from the surface of a metallic plate where ions hit; detection efficiency based on acceleration voltage of ions
Ultraviolet rays	• MCP • PMT: Photomultiplier Tube • PD • PD-EBCCD
X-ray	• MCP • X-ray Image intensifiers: Different image intensifiers mentioned in section 4(B). Detectors used in x-ray equipment, do not apply MCPs.

Table 4: Alternative Detectors by input

MCPs have unique properties which other detectors cannot replicate. In the previous consultation for MCPs, Oeko/Fraunhofer reported that the proposal wording excluded certain properties which other detectors can detect. As a result, exemption No.39 was established and they proposed the following wording which shows properties of MCPs and other detectors.

(a) a compact size of the detector for electrons or ions, where the space for the detector is limited to a maximum of 3 mm/MCP (detector thickness + space for installation of the MCP), a maximum of 6 mm in total, and an alternative design yielding more space for the detector is scientifically and technically impracticable;

MCPs, contrary to other detectors, can be installed even when only little space is available. Additionally to the maximum MCP thickness of 1 mm, or 2 mm on special demand, 1 mm of additional space is required for the installation of the MCP, resulting in a maximum space (- dimension width) of 3 mm/MCP. PDs are thin as well (down to 1.5 mm), but they cannot detect ions or electrons. The only alternative detector for electrons and ions is the PMT, which has a minimum thickness of 60 mm. PD-EBCCDs can detect electrons, but are at least 16.8 mm thick. Assuming that 3 of the 2 mm MCPs would be stacked – resulting in a total of 3 x 3 mm = 9 mm - the minimum thickness requirement of 3 mm per MCP in the exemption wording still restricts the use of MCPs to those cases where alternative detectors are too big to be used.

(b) a two-dimensional spatial resolution for detecting electrons or ions, where at least one of the following applies:

i. a response time shorter than 25 ns;
ii. a sample detection area larger than 149 mm^2
iii. a multiplication factor larger than 1.3×10^3

Besides MCPs, only the PD-EBCCD can detect two-dimensional information. However, the PD-EBCCD cannot achieve a response time of less than 25 ns, and it cannot detect sample areas larger than 149 mm^2. Furthermore, the maximum multiplication factor of the PD-EBCCD is 1.3×10^3. Performances higher than these threshold values for the two-dimensional spatial resolution of the input signal require the use of MCPs.

(c) a response time shorter than 5 ns for detecting electrons or ions;

For ions and electrons, only MCPs can detect signals faster than 5 ns. EMTs can detect ions and electrons with a minimum response time of 5 ns, but not faster. The response time of PDs (0.2 ns) and of PMTs (3.27 ns) is shorter than 5 ns, but they cannot detect ions or electrons. The detection of ions and electrons with a response time of less than 5 ns, therefore, is only viable with MCPs.

(d) a sample detection area larger than 314 mm^2 for detecting electrons or ions;

Besides MCPs, only EMTs can detect ions and electrons. EMTs are limited to a maximum detection area of 314 mm^2. PD-EBCCD can detect electrons only, but not over a sample area of more than 149 mm^2. For the detection of ions and electrons, only MCPs hence can cope with sample areas of more than 314 mm^2.

(e) a multiplication factor larger than 4.0 × 10^7

Besides MCPs, EMTs achieve a multiplication factor as high as 4.0 x 10^7. Only MCPs can perform even better, because up to 3 MCP's can be stacked. The individual multiplication factors of each MCP in the stack are then multiplied. For example, if two MCP's with a multiplication factor of 10^3 each are stacked, the resulting multiplication factor is 10^3 x 10^3 = 10^6. With three MCP's stacked, the resulting multiplication factor is about 10^8, not 10^9, because of a saturation that comes into effect in this case. However, MCP have a higher multiplication factor than the best EMTs.

In summary, MCP and the potential substitutes are compared in the table below. Data relevant to paragraphs (a) to (e) above are identified in the table below.

Detector	Detectable input	Dimensions of spatial input signal resolution	Thickness (mm)	Response time (ns) (*1)	Detection area (mm2)	Multiplication factor per detector (*2)	Possibility of stacking
MCP	• Ionising radiation • UV light • Electrons • Ions	1 and 2	0.2–1.0 2.0 on special order	≥ 0.2	50–10,000	10^3–10^8	Up to 3 MCPs
EMT	• Electrons • Ions	1	60–150	≥ 5	48–314	5.0 x 10^5 to 4.0 x 10^7	no
PD	• UV light • Visible light • Near infrared light	1	≥ 1.5	≥ 0.2	0.01 - 1,000	≤ 50	no
PD	• Specified for UV light	1	1.65–4.9	≥ 0.4	0.03–100	≤ 50	no
PD-EBCCD[382]	• Electrons • UV light	1 and 2	16.8	≥ 25	63–149	7.0 x 10^2 to 1.3 x 10^3	no
PMT	• UV light	1	18.2–127	≥ 3.27	50–2,123	1.6 x 10^5 to 1.9 x 10^7	no

(a) (b) (c) (d) (e)

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

Reliability is not an issue because in applications where exemptions 3 and 39 permit the use of lead-based MCP as there are currently no suitable alternatives.

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.

Hamamatsu photonics has been undertaking research and development of ALD-MCP since 2012, then they achieved a prototype of lead-free ALD-MCP in 2018. This lead-free ALD-MCP is made of lead-free glass capillaries and doesn't contain restricted substances of the RoHS directive. Figure 6 shows that lead-free MCP performance is better than lead-based MCP regarding gain (Generally, gain is amplification of the input signal).

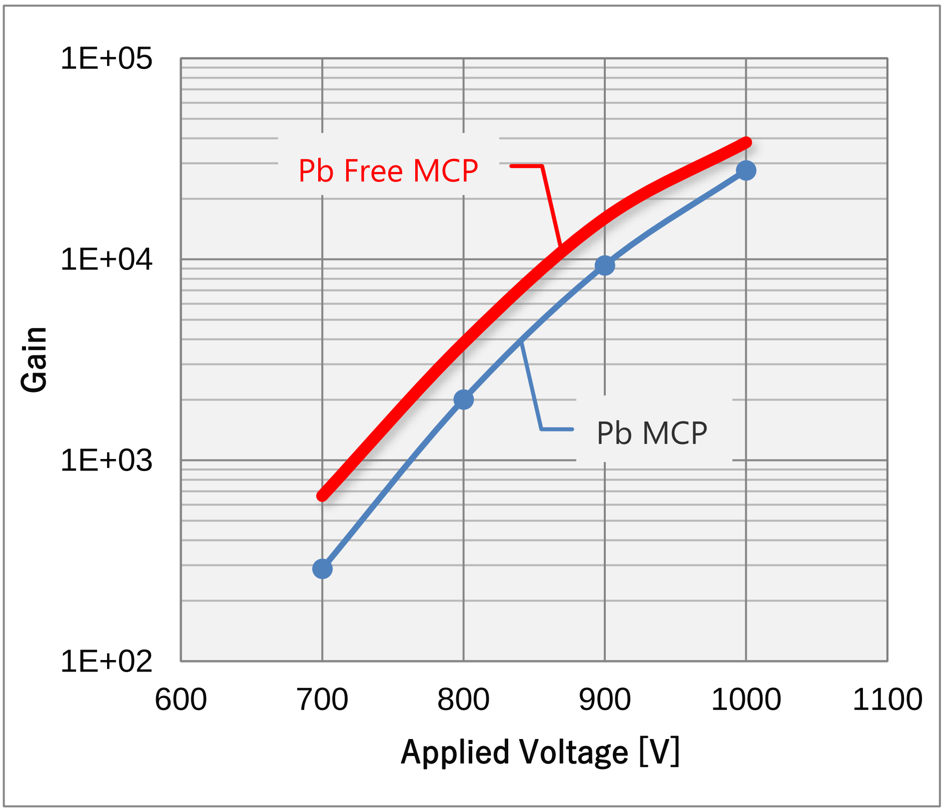


Figure 6: Typical Gain characteristic of a single MCP

Hamamatsu photonics has provided prototype of lead-free ALD-MCPs to equipment manufacturers since 2019 who have been testing their equipment with lead-free ALD-MCPs. The in-service data is currently being compiled by end-users and therefore is not yet available as further R&D is needed. This research is continuing and is expected to last until 2025, due to the requirement for additional testing as outlined in Section 7(B).

(B) Please elaborate what stages are necessary for establishment of possible

substitute and respective timeframe needed for completion of such stages.

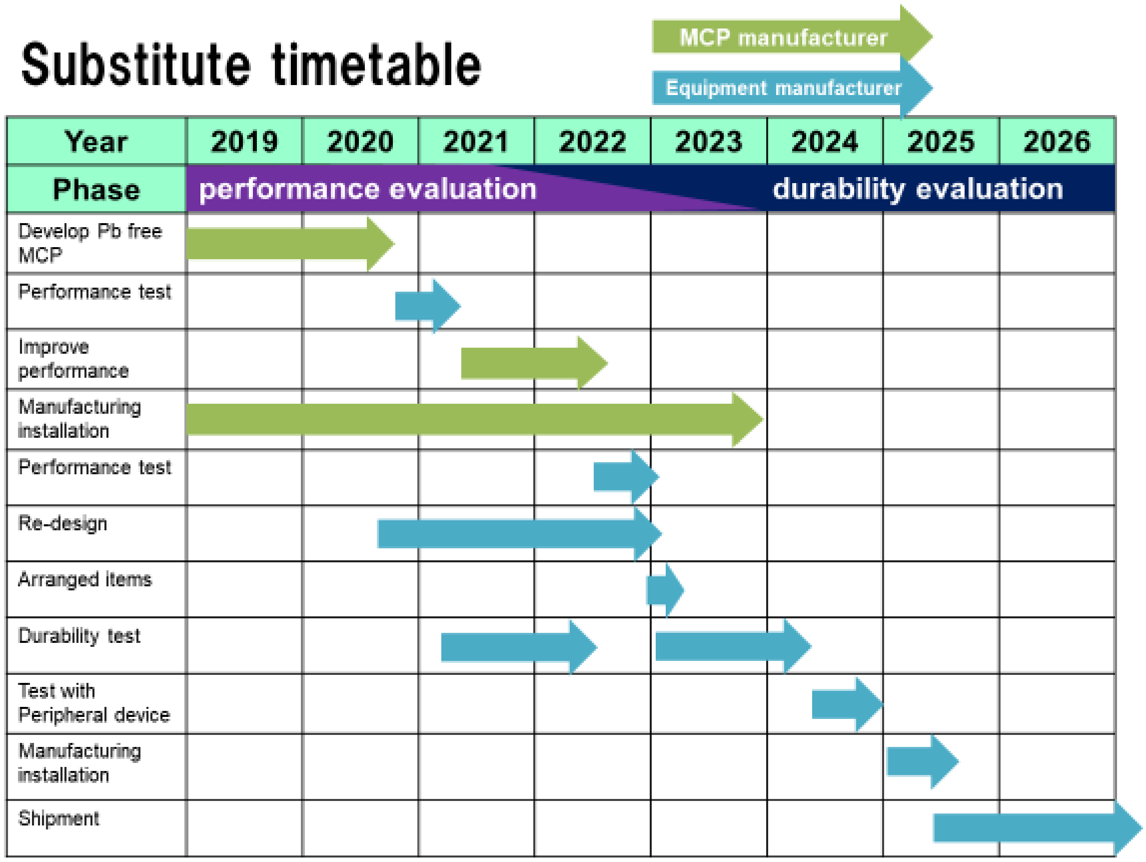
According to the previous consultant report, a 3-7 year development period shall be needed once a lead-free MCP or an alternative RoHS-compliant technology becomes available. Furthermore, it is required by equipment manufacturers that a full model change for the analytical instruments of high quality that use MCP, such as TOF-MS, Transmission Electron Microscope, may be accomplished in a 10-year cycle subsequent to this due to the additional testing required.

The latest substitute strategy from MCP manufacturer Hamamatsu photonics and equipment manufacturers plan to undertake the performance evaluation process from 2019 to 2023 and durability evaluation process from 2021 to 2026. It should be noted that the durability evaluation can only start after the results of the performance test have been evaluated due to the requirement to redesign before these tests can start.

In this strategy, after developed lead-free ALD-MCP, MCP manufacturer predict selecting one improvement based on the feedback from equipment manufacturers. MCPs have a variety of shapes and it is expected that it will take 5 years to establish the manufacturing installation for all kinds of MCPs. Equipment manufacturers undertake validation of their equipment twice, then they complete re-design of equipment. Moreover, they update data of arranged items, take cooperating test data with peripheral equipment and establish manufacturing installation for equipment. In parallel, they take durability evaluation.

In conclusion, the fastest shipment of equipment with lead-free MCP could be in late 2025 (however late 2026 is more realistic). This is based on the assumption that each of the tests are successful. It may happen that the timing of market launch is delayed due to the requirement to gain a suitable amount of reliability data before products can be updated which is reliant on the interim report on durability evaluation, which is particularly important to long life items. This substitute strategy is based on simple replacement of MCP inside equipment. However, it will take more years to complete substitution if it is necessary to re-design entire equipment after evaluation test of lead-free ALD-MCP.

For clarity the above mentioned timescales have been summarised below:



---

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

☑ lead compounds is refered in entry 63 of AnnexXVII. (A)PbO is one of lead compounds but the scope of entry 63 is only jewellery articles. MCP is not a jewellery article. Further, Entry 63 shall not apply to articles within the scope of Directive 2011/65/EU.

☐ Registry of intentions

☐ Registration

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

Name of document: N/A

(B) Elimination/substitution:

1. Can the substance named under 4.(A)1 be eliminated?

   ☐ Yes. Consequences .

   ☒ No. Justification: It is not yet possible to eliminate lead in MCPs with lead-free ALD-MCPs which are currently under the test

2. Can the substance named under 4.(A)1 be substituted?

   ☐ Yes.

   ☐ Design changes:

   ☐ Other substance:

   ☒ No.

   Justification: Re-design will first be required before it is possible to install ALD-MCPs and this is possible only if the ALD-MCPs provide the required performance. At present this is not known as further testing is needed.

3. Give details on the reliability of substitutes (technical data + information): see answers to 6(B)
4. Describe environmental assessment of substance from 4.(A)1 and possible substitutes with regard to
   1) Environmental impacts:
   2) Health impacts:
   3) Consumer safety impacts: _____

⇨ Do impacts of substitution outweigh benefits thereof? N/A

Please provide third-party verified assessment on this: N/A

(C) Availability of substitutes:

a) Describe supply sources for substitutes: substitute lead-free glass is made in Japan, but it is not yet confirmed if the substitutes provide the required performance and further testing is required

b) Have you encountered problems with the availability? Describe: N/A

c) Do you consider the price of the substitute to be a problem for the availability?

   ☐ Yes ☑ No purchase quantity would be small

d) What conditions need to be fulfilled to ensure the availability? N/A

(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   If this exemption is not renewed, EU researchers, semiconductor manufacturers, etc., will not have access to the advanced instruments that rely upon MCP and so will be at a significant competitive disadvantage compared with their non-EU counterparts.

☐ Possible social impacts external to the EU

☐ Other: _____

⇨ 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:

MCP manufacturers

In the previous consultation report, it is written that Major manufacturers of lead contained MCP are Photonis (USA, France), Litton (USA), Baspik (Russia), and Great Wall (China) other than Hamamatsu photonics.

Currently, Incom（USA）is a manufacturer of lead-free MCPs. Their MCPs have potential to replace lead-based MCP but there is insufficient data to determine if it is able to be a substitute technology so far.

Another lead exemption: 7(c)-i of AnnexⅢ

JBCE asserts that lead-MCPs are NOT covered by 7(c)-i of Annex III. In the ERA final report(7), it was concluded that an exemption would not be required if MCP are defined as electronic components using existing exemption which 7(c)-i in the current RoHS Directive. Consequently, EU-COM established the exemption for lead-MCPs as No.3 of Annex IV presumably as it agreed that 7c-I was not applicable to MCP. Moreover, JBCE received question from Oeko institute when JBCE required the new exemption for another lead-MCPs application in 2012. The question asked for the reason why MCPs are NOT covered by 7(c)-i of Annex III (8), then JBCE explained the background and its assertion. Oeko/Fraunhofer asked Photonis which a manufacturer of MCPs based in Europe if the new exemption is necessary or not. Photonis supported the new exemption: 13.3.2 Stakeholders Supporting the Exemption Request[2]. For these reasons, it is understood that lead-MCPs are NOT covered by 7(c)-i of Annex III or other existing exemptions.

---

(7) Review of Directive 2002/95/EC(RoHS) Categories 8 and 9 Final report https://ec.europa.eu/environment/waste/weee/pdf/era_study_final_report.pdf

(8) Specific questions to RoHS exemption request 10, Request 10 "Lead in micro-channel plate" https://rohs.exemptions.oeko.info/index.php?id=140

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: