Beryllium Science & Technology Association

European Semiconductor Industry Association

To the attention of:
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Comments to 2018 Stakeholder Consultation 1 in the frame of the Study to support the review of the list of restricted substances and to assess a new exemption request under RoHS 2 (Pack 15)

Introduction

BeST - Beryllium Science and Technology Association – represents the suppliers of beryllium metal and beryllium-containing alloys in the EU market and has the objective of promoting sound policies, regulations, science and actions related to the use of beryllium as well as promoting good practices in the workplace, in order to protect workers handling beryllium-containing materials.

The **European Semiconductor Industry Association (ESIA)** is the voice of the Semiconductor Industry in Europe. Its mission is to represent and promote the common interests of the Europe-based semiconductor industry towards the European Institutions and stakeholders in order to ensure a sustainable business environment and foster its global competitiveness. As a provider of key enabling technologies the industry creates innovative solutions for industrial development, contributing to economic growth and responding to major societal challenges. Being ranked as the most R&D intensive sector by the European Commission, the European Semiconductor ecosystem supports approx. 200.000 jobs directly and up to 1.000.000 induced jobs in systems, applications and services in Europe. Overall, micro- and nano-electronics enable the generation of at least 10% of GDP in Europe and the world.
ESIA is an industry association under the EECA umbrella. EECA is registered in the EU Transparency Registry: 22092908193-23

The comments below reflect BeST's views on the proposed questions of the of the 1st stakeholder consultation within the frame of the Study for the review of the list of restricted substances and to assess a new exemption request under Directive 2011/65/EU (RoHS 2) – Pack 15. These comments are also endorsed by ESIA.

1. **General Questions**

a. **In past processes for identifying substances of relevance for possible restriction under RoHS, only beryllium metal and beryllium oxide were considered. The current assessment looks at a broader scope in this respect, namely beryllium and its compounds. Please specify, should a restriction be considered, if it should be limited to beryllium metal and beryllium oxide or expanded to include beryllium and its compounds.**

BeST would first like to note that Electrical and Electronic Equipment (EEE) manufacturers use beryllium only as metal, mainly as alloying element in copper (maximum 2% beryllium in copper) and as beryllium oxide ceramic (BeO). Copper beryllium alloys (CuBe) offer the best possible combination of mechanical strength and electrical conductivity in EEE, whereas BeO has unique properties as an electrical insulator and thermal conductor. Beryllium salts or soluble compounds are not used in EEE. Therefore, BeST confirms that the scope "beryllium metal and beryllium oxide" is the only relevant scope for the RoHS directive and that it is not necessary to expand it.

As concluded in the three previous substance evaluations conducted under RoHS, beryllium metal and beryllium oxide, the only two forms of beryllium found in EEE covered under RoHS, do not satisfy the criteria required to be restricted under RoHS and therefore no restriction should be proposed.

Given the above, the broadening of the scope of the assessment to include beryllium and its compounds is not justified, especially considering that CuBe alloy is not a compound but a metal alloy containing beryllium metal.

More generally, BeST notes that, beyond the RoHS Directive and EEE, beryllium salts or soluble compounds are not commercially available or used by industry in Europe. These compounds are intermediary chemicals in the extraction process of beryllium and there is no extraction in the EU.

b. Please provide information to support your view, including information as to the use and presence of additional beryllium compounds in EEE placed on the EU market (e.g. beryllium–copper alloy, beryllium sulfate, beryllium chloride etc).

Sources:

- In 2008, the Öko Institute e.V., the leading European research and consultancy institution contracted by the European Commission to review the RoHS Directive and the list of substances contained in EEE concluded that "*Beryllium metal including composites and beryllium oxide ceramics are rarely used in consumer electrical and electronic equipment*" as their main use is *"in high-end products with long life-cycles"* where beryllium metal and beryllium oxide "*do not reject any dust or fumes when they are supplied and used in EEE applications".*

  "In contrast, beryllium-containing alloys are used in consumer products with cellular phones being the application containing the highest beryllium content" and *"existing publications examining the impacts of airborne metal exposure among workers due to shredding, roasting, milling and assaying of recycled cellular phones show that the airborne beryllium exposures are below the Permissible Exposure Limit (PEL)*".

  The study concluded that "*the available data is not considered to be sufficient by the authors of this study to justify a restriction of beryllium from EEE at the current stage*".

- In 2010, the Öko Institute e.V. concluded that beryllium and beryllium oxide ceramic, do not "*constitute significant health and environmental risks when used in electrical and electronic equipment*" and determined that beryllium and beryllium oxide "*are not proposed as candidate or phase out substances*".

2. Applications in which beryllium metal and beryllium oxide are in use

a. Please provide information concerning products and applications in which substances are used

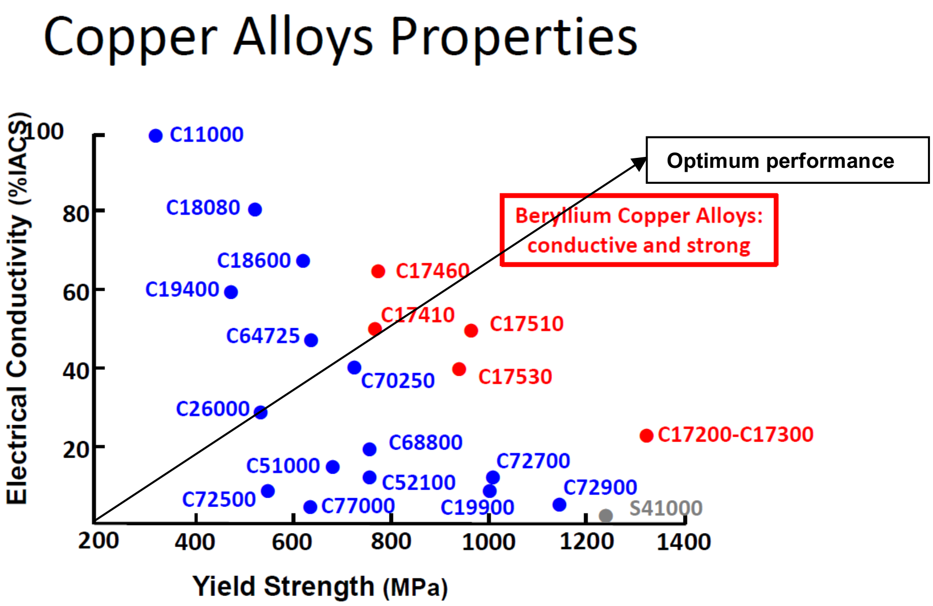
Beryllium brings unrivalled advantages to its end-use applications, whether used in its pure metallic form, as a BeO ceramic or as combined or alloyed in small amounts with other metals, mainly with copper in EEE. In many instances, no other material can deliver the same combination of performance and reliability demanded by today's high technology products and systems.

Aerospace and defence industry	Beryllium and beryllium-containing alloys are used in critical components in the manufacture of high performance military and commercial aircrafts, such as guidance systems and electronic connectors. For example, there are over 40 000 connectors containing CuBe alloys in a commercial airplane.
Medical Applications/ medical devices	Beryllium metal has the unique property of being perfectly transparent to X-Rays and is therefore indispensable in X-Ray sources used in mammography, medical imaging equipment (windows of pure beryllium) and as components of robotic surgical devices. Laser surgery devices manufactured with BeO ceramic components are providing the gift of restored or improved sight to millions around the world. BeO ceramics are integral components in advanced cancer therapy machines, medical lasers for DNA analysis, equipment for skin resurfacing, non-invasive surgery, kidney stone removal, detection of blindness and HIV testing.
EEE	Beryllium, mostly in the form of CuBe alloys containing less than 2% of beryllium, is used in EEE to increase electrical and thermal conductivity, enhance product performance, increase reliability, extend products life and facilitate miniaturization of components and products. CuBe alloys used in springs, switches, and the terminals of electrical connectors allow manufacturers of aircraft, automobiles, computers, cell phones, telecommunications equipment and other electronics to reliably design for the protection of the public, life-saving applications, miniaturization and energy conservation. CuBe alloys are also key to fight planned obsolescence, in particular in the computers, cell phones and home appliances. CuBe alloys are essential in the connectors of electrical cars, autonomous vehicles, and solar panels, and contribute to the development of environmentally friendly technology and equipment.

i. In your answer please specify if the applications are relevant to EEE products and applications or not

The above applications are extremely relevant to EEE products. The vast majority of applications involve the use of CuBe alloys in automotive, aerospace, telecommunications, computers and industrial and medical technologies as they have a long service life and are reliable, inert, stable, and do not give off emissions during use. Applications within EEE comprise the largest use of CuBe alloys and hence the largest use of beryllium metal.

Market forces and commercial considerations, such as the relatively high initial cost, ensure that beryllium-containing alloys are only used in key places in products where they provide the only solution that supports safety, reliability, extended service life, miniaturization, and/or improved energy management. BeST notes that CuBe alloys are generally higher in initial cost compared to other alloys on the market. Users choose them because they present the best combination of properties, especially in terms of mechanical strength and electrical conductivity and therefore represent a lower overall cost based on performance. Unlike suggested by a respondent to the consultation, titanium copper alloys do not offer the same performance in terms of electrical conductivity. BeST would like to draw the attention of the evaluators to the following graph, showing that no other copper alloy, containing titanium or any other alloying element, can provide equivalent performance to that of CuBe alloys.



Legend:

- **C11000 – Copper**
- **C17200 - Copper Beryllium**
- **C17300 - Copper Beryllium**
- **C17410 - Copper Beryllium**
- **C17460 – Copper Beryllium**
- **C17510 - Copper Beryllium**
- **C17530 - Copper Beryllium**
- **C18080 – Copper Chromium Silver**
- **C18600 – Copper Chromium Zirconium**
- **C19400 – Copper Iron Zinc**
- **C19900 – Copper Titanium**
- **C26000 – Copper Zinc (Brass)**
- **C51000 – Copper Tin Phosphorous (Bronze)**
- **C52100 – Copper Tin Phosphorous (Bronze)**
- **C64725 – Copper Nickel Zinc**
- **C68800 – Copper Zinc Aluminium**

- **C70250 – Copper Nickel Silicon**
- **C72500 – Copper Nickel Tin**
- **C72700 – Copper Nickel Tin**
- **C72900 – Copper Nickel Tin**
- **C77000 – Copper Nickel Zinc**
- **S41000 – Iron Nickel Chromium (Stainless Steel)**

BeST notes that potential substitutes also have potential hazards that increase the risk of adverse health effects during production, use and recycling. For example, copper titanium, a proposed alternative to CuBe alloys (see JX Nippon NKT322 - Alternative to Copper-Beryllium) has a work-related cancer risk classification similar to that of CuBe. ECHA has concluded that titanium dioxide (TiO_2), a compound of titanium, meets the criteria to be classified as a Category 2 carcinogen (see https://echa.europa.eu/-/titanium-dioxide-proposed-to-be-classified-as-suspected-of-causing-cancer-when-inhaled). As TiO_2 is produced during the production of copper titanium alloys, there is a significant potential risk of exposure to workers during production and handling of copper titanium alloys. It is notable, that the current EU cancer classification for beryllium has not been re-evaluated in light of the 2016 publication of the largest-ever study of cancer risk among beryllium workers. The study concluded that beryllium metal and beryllium oxide operations impart no excess cancer risk to beryllium workers (Boffetta et al. 2016)[1].

The continuous trend in the design of electrical equipment is for the miniaturization of components, including connectors, to decrease overall size or weight, and to provide higher performance capability in the product. However, this must be achieved without sacrificing connector reliability. CuBe alloys present excellent formability and therefore offer the designer the flexibility to employ smaller sized terminals and contacts while still obtaining the required reliability and performance.

The combination of high strength, thermal and electrical conductivity, formability, spring properties, fatigue life, and resistance to deformation at elevated temperatures provided by CuBe alloys allows a designer to use smaller section terminal beams than are not possible with other candidate alloys.

In addition to reducing the weight of metal required, the use of CuBe allows the use of less plastic in the connector housing which results in using less weight and total energy, and less cost for end-of-life management. Up to 80% material weight savings have been achieved by using CuBe alloys compared to other lower performing connector alloys. This weight reduction along with superior performance characteristics and reliability are the primary reasons why CuBe is selected. Though the cost per unit of weight may be higher than many other alloys, the overall cost in the application is lower due to less material being used (up to - 50%), while providing superior performance.

Regarding medical imaging equipment, pure beryllium metal is used for X-Ray windows. Beryllium metal is the only material that is perfectly transparent to X-rays. Other materials can be used but result in significantly reduced resolution of the medical images. That is why beryllium plays a key role in the detection of tumors.

[1] Boffetta P, Fordyce TA, Mandel JS.Cancer Med. 2016 Dec;5(12):3596-3605. doi: 10.1002/cam4.918. Epub 2016 Oct 20. A mortality study of beryllium workers.

ii. **Please elaborate if substitution of the substance is already underway in some of these applications in relation to the properties for which beryllium metal and beryllium oxide are used and/or in relation to specific applications in which it is used (for example beryllium copper alloys used in flexible contacts for batteries), and where relevant elaborate, which chemical (substance level) or technology (elimination of the need for beryllium) alternatives may be relevant for this purpose.**

It is not expected that any significant volume of beryllium usage can be substituted without an unacceptable loss of performance, particularly since almost all applications are in areas where high reliability is essential for lowering the risk of loss of life.

Beryllium has been designated by the European Commission as one of twenty-seven materials critical to the EU due to its critical applications and to the risks for supply shortage and its impact on the EU economy.

As mentioned above, other copper alloys containing other metallic elements such as nickel, tin, titanium, zinc and zirconium are available on the market but do not offer the same combination of properties. These alloys are initially less expensive (factor 2 up to 4). For obvious price reasons, users will select these potential alternatives if they do not need the performance of CuBe and are able to meet their technical requirements.

b. **Please specify if you are aware, if aside from actual use of the substances, it may be reintroduced in to the material cycle through the use of secondary materials.**

i. **Please detail in this case what secondary materials may contain impurities of beryllium or of its compounds (please specify which) and at what concentrations as well as in the production of what components/products such materials are used.**

It is highly unusual for pure beryllium metal and beryllium oxide ceramic to directly enter the normal metals recycling stream, mostly because of its relatively small use and high monetary value as a clean scrap metal.

CuBe alloys that are not able to be separated because it is embedded in a device that is not disassembled at the end of its product life is normally processed in the copper waste recovery process. The processing of low beryllium content electronic/electrical devices in the general copper waste stream is usually done via melting which results in forming slag containing much of the beryllium content from the melt, and the dilution of any remaining beryllium to levels comparable to new copper metal.

ii. **If possible please provide detail as to the changing trends of concentrations of beryllium and its compounds in such secondary materials as well as the changing trend of use of the respective secondary material in EEE manufacture.**

CuBe alloys recycled with copper or other copper alloys do not significantly increase the beryllium concentration. It can generate traces of beryllium in copper, knowing that many ores, metals and alloys already contain traces of beryllium as a naturally occurring element present in the earth crust.

BeST notes that a study conducted in UK in a WEEE recycling unit indicates that there is no substantial emission of beryllium or worker exposures above the detection limit. See the response in 4.a section for additional information.

3. Quantities and ranges in which beryllium and its compounds are in use

Annual worldwide production/consumption of beryllium (in alloys, metal and ceramics) in 2014 is estimated as 300 MT, with alloys representing about 90%. Beryllium annual consumption is expected to grow to 425 MT/year 2020 and to >450 MT/year by 2030, driven largely by applications such as the International Thermonuclear Experimental Reactor (ITER) fusion reactor in Cadarache, France which will use pure beryllium in the construction of the first wall due to fact that beryllium is the only material that can withstand the high temperatures and conditions generated in the reactor. Beryllium will also be used in the second wall for its desirable nuclear properties as a neutron reflector.

Market research reports provide the end-use market by sector as (Globally):

Telecommunications electronics (EEE):	51.7%
Automotive electronics (EEE):	13.3%
Aerospace / Defence: (EEE & Structural):	16.4%
Industrial Components:	11.6%
Other:	7.0%

a. Please detail in what applications your company/sector applies beryllium and its compounds and give detail as to the annual amounts of use (please specify which data is relevant for which compound). If an exact volume cannot be specified, please provide a range of use (for example – 50-100 tonnes per annum).

The EU does not import any beryllium ores as there is no beryllium extraction processing undertaken in the EU. Europe imports 100% of the refined beryllium used in the EU in the forms of Beryllium-containing alloys and master alloys as well as beryllium metal and BeO.

The annual EU consumption is approximately 50 tonnes (Bio Intelligence Service, 2015; Freeman, 2016).

b. Please provide information as to the ranges of quantities in which you estimate that the substance is applied in general and in the EEE sector.

BeST and Bio Intelligence Service provide the end-use market by sector (in the EU) as:

Telecommunications electronics (EEE):	40%
Automotive electronics (EEE):	16%
Automotive components:	16%
Aerospace components and EEE:	10%
Energy applications:	8 %
Moulds:	3%
Metal:	3%
Others:	4%

Total consumption: 50 tonnes

c. If substitution has begun or is expected to begin shortly, please estimate how the trend of use is expected to change over the coming years.

There have been continuous attempts to substitute materials for beryllium and alloys containing beryllium over the 90 years that it has been available as a material in commerce.

With the availability of computer aided design, added to commercial pressures to reduce cost of materials used in EEE and other applications for beryllium, and added to the regulatory pressure, all the potential substitutions in which reduced material properties do not lead to an unacceptable loss of performance or safety have been made.

As stated above, it is not expected that any significant volume of beryllium usage can be substituted without an unacceptable loss of performance.

4. Potential emissions in the waste stream

a. Please provide information on how EEE applications containing beryllium and its compounds are managed in the waste phase (with which waste is such EEE collected and what treatment routes are applied)?

Pure beryllium metal components used in technological applications have extremely long lifetimes, and therefore return to the recycle stream very slowly or do not return at all (e.g. applications in space). When pure beryllium components do finally return, they can be easily recycled. Production scrap from operations such as machining or stamping is gathered and returned for recycling. In all cases, the recycling of beryllium metal results in a significant energy saving of over 70% compared to extracting beryllium from ore. BeST notes that the recycling operations of beryllium metal as pure metal or as alloying element are conducted outside the EU, mainly in US, Japan, Kazakhstan and China.

It should be noted that the applications of beryllium metal and BeO ceramics are highly specialized, and highly technological, rather than commercial or consumer in nature. Recovery of beryllium metal from beryllium-containing alloys in EEE (for example, the copper beryllium components included in end of life electronics) is not performed because of the small size of the components and the relatively low beryllium content per device (less than 40 ppm, even in devices with the highest beryllium content).

Alloys containing beryllium make up approximately 0.15% of all copper alloys used in EEE, which during pre-processing of end-of-life equipment are collected together with other copper in the scrap and subsequently diluted to ~ 2 ppm in the copper recycling stream. In responsible copper recycling processes that currently exist in the EEA, the extremely small quantities of beryllium metal are immobilized in slags, separated from the recycled copper and do not present an exposure hazard to recovery workers or a hazard to the environment.

A study on the recycling of beryllium and the occupational exposure of workers to beryllium in the electronic recycling industry was published in 2014. The report presents the results of a quantitative airborne metal exposure survey conducted on workers shredding, picking and separating WEEE in a specialized, modern recycling facility in the United Kingdom. The results of personal lapel samples collected and analyzed for beryllium during shredding, picking and separating operations were below the level of analytical detection (0.007 microgram/sample) and therefore well below the respective Health and Safety Executive (HSE) of the United Kingdom's Workplace Exposure Limits (WEL). The results of the occupational exposure assessment coupled with the analysis of the beryllium content of the electrical and electronic equipment demonstrate that processing WEEE utilizing modern processing techniques represents minimal risk of exposure to beryllium.[2]

The mentioned study can be found on our website: http://beryllium.eu/wp-content/uploads/2016/07/Beryllium-Exposure-Assessment-during-WEEE-Recycling-23-Jan-14.pdf

Furthermore, BeST notes that its members recover (buy back) production scrap from their customers. This scrap is collected, sorted, and sent back to US or Japan to be recycled in new strips, rods, wires or master alloys used by the industry. The recovery activity is growing in EU and contributes to an environmentally friendly circular economy. These recovery and recycling activities are conducted by organizations that are aware of the inhalation risk in the workplace and which implement efficient and effective risk management measures. This recycling process is therefore a way for BeST members to better control the exposure risk by avoiding external recycling operators.

b. In the treatment and the destruction processes of electronic components beryllium oxide can be released and result in health risks for workers. Please detail potentials for emissions in the relevant treatment and disposal processes specified relevant to each application EEE. Please also detail how such impacts can be mitigated and to what degree such practices are applied in recycling facilities in the EU and outside the EU.

The report mentioned above in Section 4a presents the results of a quantitative airborne metal exposure survey conducted on workers exposed to beryllium, including beryllium oxide.

Further studies on recycling can also be found on our website at the following address – recycling tab:
http://beryllium.eu/resources-2/

These include:

- Report No. 2010-0100-3217 July 2014 on the "Evaluation of Occupational Exposures at an Electronic Scrap Recycling Facility" by the National Institute for Occupational Safety and Health (NIOSH)
- Characterization and Analysis of Airborne Metal Exposures among Workers Recycling Cellular Phones (2007) by M.S. Kent, M.M. Corbett and M. Galvin

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[2] Theodore l. Knudson, CIH Materion Brush Inc. and Huw Wilkins, LFOH Huw Wilkins Associates LLC, An Evaluation of Airborne Beryllium Exposures during recycling of waste electrical and electronic equipment (WEEE), Published in the Proceeding of the 13th International Electronic Recycling Congress (IERC), Salzburg, Austria, January 23, 2014.

- Characterization and Analysis of Airborne Metal Circuit Board Shredding (2006) by M.S. Kent, M.M. Corbett and M. Galvin

The above studies conducted on workers shredding, picking, and separating significant volumes of WEEE, concluded that there is no significant beryllium inhalation hazard to the workers.

c. Please specify if there is a risk for emissions of additional beryllium compounds.

As previously stated, beryllium metal and beryllium oxide are the only two forms used in EEE. CuBe alloys are not compounds and fall within the general classification of beryllium metal. BeO is a highly insoluble beryllium compound and is already listed. There is no risk from emissions of any other beryllium compounds as described in the aforementioned information.

5. Substitution

a. Please provide details as to the substitution of beryllium and its compounds (as a minimum for beryllium metal, beryllium oxide and beryllium copper alloys):

i. For which applications is substitution scientifically or technically not practicable or reliable and why.

Substitution of beryllium always leads to a loss of performance. As beryllium is more costly than potential alternatives, it is only used when considered when its unique and enabling properties are absolutely essential.

For example, CuBe is only used when absolute reliability is essential to ensure safe operation in the defence, transport or energy sector (e.g. see the graph on paragraph 2 a i. – no other copper alloy can present the same strength/conductivity combination). Pure beryllium and Al-Be (62% Be) alloys are used only in applications where their unique properties are essential to meet the most demanding performance requirements.

Consequently, beryllium is used to ensure high performance and reliability in life safety related applications (transport, defence and energy application) and cannot be substituted.

No other alloys, metals, or composites offer the same combinations properties of CuBe alloys, AlBe alloys or pure beryllium. In all cases, the improper substitution of beryllium alloys, metals, or composites can and has resulted in equipment failures affecting the safety of citizens and society (transport, fire protection, medical equipment, defence).

The availability of substitutes has been and continues to be assessed by the electronics industry. For example, a project was conducted by the High Density Packaging User Group (HDPUG)[3] to identify and evaluate the performance, cost, availability and environmental attributes of potential substitutes for beryllium-containing materials. The project identifies potential substitutes for

[3] Beyond RoHS - Evaluation of Alternatives to Environmentally-sensitive Materials - DfE Phase III Date 12-14-05 Rev 1.0 High Density Packaging User Group.

CuBe alloys and BeO ceramics. However, the study found that *"few of the identified alternatives provide the same level of performance to CuBe alloys."* The project report also stated *"alternatives to beryllium containing ceramics do not appear to be well developed and do not appear to provide equivalent performance at the same cost."* When performance and reliability are important in EEE, then there is no substitute for beryllium, CuBe alloys or BeO ceramic.

ii. For which application is substitution underway. Please specify in this respect which alternatives are available on the substance level (substitution) and which are available on the technological level (elimination) and in which of the beryllium applications they can be applied (for example which substitutes can be applied for copper beryllium alloys used in flexible contacts for batteries).

The following types of materials have been considered for substitution of Be and have presented the following issues:

Application Sector:	Attempted Substitute Materials:	Issue:
Telecommunications electronic/Automotive electronics/Aerospace and Defence electronics	Alloys of copper: e.g. CuZn Brasses; CuSn Bronzes, CuNiSi alloys etc.	Insufficient combination of strength/ formability/electrical conductivity/ stress relaxation resistance/failure to resist vibration/corrosion resistance
Aerospace/Defence structural components	Titanium	Higher density / Lower specific stiffness (Modulus/Density)
	Carbon Fibre composites	Formability/High and Low temperature properties/Specific stiffness/ Weldability/Fracture toughness Impact resistance/Specific Heat
Aerospace/Defence industrial components	Alloys of copper: e.g. CuZn Brasses; CuSn Bronzes, CuNiSi alloys etc.	Insufficient combination of strength/ formability/thermal conductivity/ stress relaxation resistance/failure to resist vibration/corrosion resistance
Other: e.g. X-Ray Windows	Titanium / Aluminium / Polymers/Glass	Reduced resolution of the X-Ray or CT Scan images leading to reduced detection of tumours and medical issues
e.g. Beryllium Oxide Laser Bores	Aluminium Oxide ceramic	Thermal conductivity
e.g. ITER fusion reactor lining	Tungsten	Fail safe nuclear interaction of Beryllium as a neutron reflector is lost, reducing safety margin in the event of loss of magnetic control of the hot gas plasma

References:
Merchant Research & Consulting Ltd, London, 2012: Beryllium Market Review
Global Industry Analysts Inc., San Jose, CA, USA. Oct 2008: Beryllium – A Global Strategic Business Report
US Geological Survey, 2014: Mineral Commodity Summaries, Beryllium
British Geological Survey: Critical Metals Handbook, ed. G. Gunn, Pub. Wiley 2014 pp 99-121
http://beryllium.eu/about-beryllium/facts-and-figures/

iii. What constraints exist to the implementation of the named substitutes in a specific application area (provide details on costs, reliability, availability, roadmap for substitution, etc.)

Beryllium metal, beryllium oxide and beryllium alloys have unique properties and are irreplaceable for specialized manufacturing and use in EU industries such as electronics, aerospace, automotive, defence and medical.

In all cases of attempted substitution, there is a reduction in performance which can be significant particularly when the combination of properties is for the benefit and safety of society.

As mentioned previously, beryllium as pure metal and also as an alloying element in copper is relatively expensive compared to potential substitutes. Therefore, if there is a suitable substitute, this has been already done. The higher price causes companies to consider substitution. The regulatory pressure on beryllium a also influences users to substitute it when possible.

6. Socio economic impact of a possible restriction

Please provide information as to the socio-economic impacts of a scenario in which beryllium metal and beryllium oxide or beryllium and its compounds are restricted under RoHS. Please specify your answers in relation to specific applications in which the substances are used and/or in relation to the phase-in of specific alternatives in related application areas. Please refer in your answer to possible costs and benefits of various sectors, users, the environment, etc. where possible; please support statements with quantified estimations.

Any extension of the scope of the RoHS Directive will be counter-productive to investment in the development of new technologies due to the uncertainty introduced in the market. EU risks losing entrepreneurship, innovation, and advances in reliability, raw material utilization and energy conservation when it sends conflicting or duplicative messages to the industrial sector. The EU also risks having consumers being forced into accepting products that are of lower quality, lower performance and lower reliability without any quantifiable safety or environmental benefits.

This is particularly true with regard to the use of beryllium-containing materials. Although classified as hazardous substances, beryllium metal, beryllium alloys and beryllium oxide are used in critical applications which are vital to European technology, offering property combinations not available in other materials, and allowing European designers to achieve world class levels of innovation, performance, energy efficiency and reliability. Beryllium-containing materials have historically been on the cutting edge in technology development.

In addition to this loss of innovation power, a RoHS restriction would have direct economic consequences in the EU. According to the socio-economic impact assessment recently conducted and published by the European Commission in the frame of the ongoing amendment of the Carcinogen and Mutagens Directive (CMD) (Beryllium is in the third batch currently being discussed at the European Council), an estimated 5800 companies in the EU are involved with processing beryllium-containing materials. These companies, the majority of which are SMEs processing CuBe alloys for EEE, would likely close or would export their activity outside the EU in case of excessive restrictions. This would also cause market restrictions and loss of competitiveness for many EEE manufacturers in the EU.

From an environmental perspective, BeST notes that beryllium metal and alloys are used in many environmentally friendly technologies such as electrical cars and solar panels. BeST also notes that the use of CuBe alloys fosters sustainability (longer life of EEE) and limits planned obsolescence. Furthermore, the relocation of facilities processing copper beryllium articles outside the EU would generate more transport and an increased carbon footprint.

7. Further information and comments

The information compiled on these substances for the stakeholder consultation has been prepared as a summary of the publicly available information reviewed so far. If relevant, please provide further information in this regard, that you believe to have additional relevance for this review, as well as references where relevant to support your statements.

Beryllium presents no health risk to the consumers (end-users) of EEE and has no impact on the environment. The health risk is only in the work place by inhalation in case of uncontrolled dust emission.

BeST notes that there is a current regulatory review to establish an EU wide binding occupational exposure limit (OEL) for beryllium with the aim of protecting all workers, including the recycling sector. The main countries processing and recycling EEE outside the EU already have an OEL for beryllium.

On 5 April 2018, the European Commission published its proposal for an OEL for Beryllium in the frame of the Carcinogens and Mutagens Directive and proposed an OEL of 600 ng/m^3 as an 8-hour Time Weighted Average (TWA) for “Inhalable” beryllium-containing particulates, for a transition period of 5 years, to be subsequently reduced to 200 ng/m^3 inhalable 8h TWA after the transitional period.

A restriction under RoHS would therefore be redundant, unnecessary, unjustified and would constitute overregulation.

In addition, BeST has implemented an effective Product Stewardship Program to communicate best practices for safe handling of beryllium (www.berylliumsafety.eu).

We remain at your disposal to discuss the above and for any further assistance.

Maurits Bruggink
Director EU Affairs
Beryllium Science & Technology Association

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