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# The Beryllium Science and Technology Association (BeST) A European Perspective



Beryllium Science & Technology Association

[www.beryllium.eu](http://www.beryllium.eu)

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# BeST

## Presentation of the Association

**BeST**

Beryllium Science & Technology Association

# The Beryllium Science and Technology Association – BeST

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## Background

- Origin: « REACH Beryllium Consortium » (registration of beryllium in November 2006 - 2010) REACH requires that manufacturers/importers of the same substance cooperate in preparing a submission, by sharing data and costs.
- BeST officially created in September 2011
- Non-profit organization based in Brussels
- Represents the manufacturers, suppliers and users of beryllium
- Members: Materion (USA), NGK Berylco France (F), Tropag Oscar H. Ritter Nachf GmbH (D), Schmelzmetall AG (CH).

## Our Mission:

Promote sound policies, regulations, science and actions related to the use of beryllium and to serve as an expert resource for the international community on the benefits and criticality of beryllium applications.

# The Beryllium Science and Technology Association - BeST

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## Challenges over the short term

- Avoid beryllium listed in the REACH candidate list
- Ensure that the best scientific information and control models employed by the beryllium industry are used in establishing an OEL for beryllium at EU and Member States levels
- Work to have beryllium metal properly classified under GHS
- Continue to promote beryllium as a critical material

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## BeST's Activities

# The EU Regulatory Regime and how it affects the industries that use beryllium



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## BeST's Activities

# REACH – Registration, Evaluation, Authorization and Restriction of Chemical Substances



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## Overview

- REACH entered into force on 1<sup>st</sup> June 2007
- Creation of the European Chemicals Agency (ECHA) based in Helsinki, fully operational on 1<sup>st</sup> June 2008
- Registration of beryllium metal (4 companies) & beryllium oxide (2 companies) on 30 November 2010
- REACH testing results have shown that the current classification for beryllium metal needs to be changed.

# Registration, Evaluation, Authorization and Restriction of Chemical Substances

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## Overview

- Registration : Manufacturers and importers of chemicals  $\geq 1$  tpa are required to register their substances
- Evaluation of some substances by ECHA and Member States
- Authorization for Substances of Very High Concern (SVHC)
- Restriction when risks are unacceptable.

## Authorization

- Identification of SVHCs : Candidate List  
**Beryllium has not been included in the candidate list. Priority for listing on the Candidate List is:**
  - (a) Persistent, Bioaccumulative and Toxics (PBTs) and very Persistent and very Bioaccumulative (vPvBs); or (b) wide dispersive use; or
  - (c) high volumes.
- Prioritization of substances : Draft Recommendation for Annex XIV
- Inclusion in Annex XIV : Authorization List. SVHC listed cannot be produced or used unless an Authorization has been granted
- Granting Authorization (by Industry, for a specific use)

## Restriction

- Alternative to an Authorization
- Chemicals that represent unacceptable risks to human health or the environment
- Chemicals cannot be manufactured or used unless they are specifically exempted
- Beryllium has not been listed in the REACH Restriction List (Annex XVII)

## BeST activities since December 2010

- Educate Member States Competent Authorities (MSCA) and European Institutions on the most relevant and best available science on beryllium
  - Participation to hearings organized by MSCA
  - Face-to-Face Meetings with MSCA
  - Meetings with the European Commission (DG Industry and DG Environment)
  - Workshop at the European Parliament

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# BeST's Activities

## Occupational Exposure Limits at EU level



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# EU Occupational Exposure Limit Process for Beryllium

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## General Presentation

- The Scientific Committee for Occupational Exposure Limits to Chemical Agents (SCOEL) is responsible to set OELs at EU level
- EU Member States can set stricter OELs but not exceed the EU OEL
- BeST works with SCOEL and Member States since 2011

# EU Occupational Exposure Limit Process for Beryllium

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- OELs range from 2.0  $\mu\text{g}/\text{m}^3$  (most common) to 1.0  $\mu\text{g}/\text{m}^3$  (former soviet block) to 0.2  $\mu\text{g}/\text{m}^3$
- 0.2  $\mu\text{g}/\text{m}^3$  Adopted at Member State Level by:
  - ✓ Ireland
  - ✓ Spain
  - ✓ Poland
- At EU level
  - ✓ SCOEL Procedure for establishing an OEL for beryllium to begin before the end of 2012 (about 2 years procedure)
- It is believed most member states will be moving to adopt an OEL of 0.2  $\mu\text{g}/\text{m}^3$

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# BeST's Activities

## Cancer Reclassification for Beryllium Metal



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## The Current Classification Needs to be Changed for Beryllium Metal

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### Harmonised Classification and Labelling Dossier for Beryllium Metal

- Proposal for revision is generally submitted by a MSCA
  - Proposal shall include a justification on how the new science supports the proposed revision
  - MSCA submit the CLP proposal to ECHA
- ECHA procedure
  - Public Consultation
  - Risk Assessment Committee issue a scientific opinion, which ECHA sends to the European Commission
  - European Commission and REACH Regulatory Committee will decide on the harmonized classification and labelling through the Comitology procedure with scrutiny.

## The Current Classification Needs to be Changed for Beryllium Metal

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### BeST Activities on Reclassification

- Preparation of an Annex VI dossier
  - Content includes justification for classification change
- Challenges
  - Obstacles to find a Member State to sponsor the dossier :  
lack of human resources, money
  - BeST is currently meeting with several member states

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## BeST's Activities

# Supportive Assessments: Beryllium Does Not Cause Cancer



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## Supportive Assessments Be is not causing cancer

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Beryllium was evaluated during the recent review of the European Cancer Directive for the European Commission. Report stated: *The IOM Project P937/99 (2011)*.

**“there was little evidence for any important health impact from current or recent past exposures in the EU”**

A manuscript prepared by the European Commission on beryllium in relation to occupational diseases (*Information Notices on Occupational Diseases: A Guide to Diagnosis, 2009*) states that:

**“The causal relationship between prolonged or repeated exposure to beryllium and the occurrence of bronchial cancer has not been firmly established, and due to the multi-causality of the occurrence of this type of cancer, the recognition of the occupational origin must lie on a thorough assessment based on rigorous scientific criteria taking into account all possible etiologies.”**

## Supportive Assessments Be is not causing cancer

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*The Industrial Injuries Advisory Council Position Paper 27, December 2009 Beryllium and Lung Cancer (UK) stated:*

**“The Council has concluded that at present there is insufficient evidence to recommend that lung cancer in relation to beryllium should be added to the list of prescribed diseases. ”**

## Supportive Assessments Be is not causing cancer

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A study of the United Kingdom's Beryllium Registry (*Jones Williams W 1996*) that includes all cases of beryllium disease or suspected beryllium disease from 1945 to 1993, stated:

**“There were no cases of cancer.”**

## Supportive assessments Be is not causing cancer

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In a study (*Eurogip. Work-related Cancers: What Recognition in Europe 2010*) of multi-year cancer statistics from the data in occupational disease registries for Germany, Austria, Belgium, Denmark, Spain, Finland, France, Italy, Luxembourg, Netherlands, Portugal, Czech Republic, Switzerland and Sweden covering 32 million workers:

**Only (1) case of cancer related to beryllium was reported. This compares to approximately 2.4 million new cancer cases diagnosed each year in Europe**

## Supportive Assessments Be is not causing cancer

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The only studies that conclude beryllium causes cancer were carried out basically on the same group of beryllium production workers in the United States and nowhere else in the world.

## Supportive assessments Be is not causing cancer

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Recent studies by experts in **epidemiology** support the need to reclassify beryllium:

(Boffetta P. International Prevention Research Institute, Lyon, France, *Occupational exposure to beryllium and cancer risk: a review of the epidemiologic evidence. Critical Reviews in Toxicology 42(2): 107-118 2012*)

“The studies of beryllium disease patients do not provide independent evidence and the results from other studies do not support the hypothesis of an increased risk of lung cancer or any other cancer. Overall, the **available evidence does not support a conclusion that a causal association has been established between occupational exposure to beryllium and the risk of cancer.**”

## Supportive assessments Be is not causing cancer

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Recent studies by experts in **animal studies** support the need to reclassify beryllium:

*(Hollins D.M., et al. Beryllium and lung cancer: A weight of evidence evaluation of the toxicological and epidemiological literature. Crit Rev in Tox 39(1): 1-32 2009)*

This study stated “the vast majority of studies reviewed for beryllium, including the studies that reported a positive tumor response in rats, **suffered from incomplete reporting and serious methodological flaws.**”

# Supportive assessments Be is not causing cancer

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Recent Studies by experts in **animal and in-vitro** studies support the need to reclassify beryllium:

*Strupp C. (2011) Beryllium Metal I. Experimental Results on Acute Oral Toxicity, Local Skin and Eye Effects, and Genotoxicity. Ann Occup Hyg; 55: 30–42*

- Strupp presented new research results in two papers on beryllium metal. The new studies were generated in accord with OECD standards and GLP requirements in order to comply with REACH.
- Studies allow a scientific interpretation that led to decades of **erroneous conclusions that the toxicity of beryllium metal (which is commercially available) and soluble beryllium compounds (not commercially available) are the same.**
- The existing studies on carcinogenic properties were only conclusive on rats which have shown not to be a good model for predicting carcinogenicity.

## REACH Studies Showed:

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- Beryllium metal was not genotoxic and did not interact with DNA and produce mutations
- Beryllium metal did not cause structural chromosomal aberrations or forward gene mutations in mammalian cells (gene mutations are reported to be an initial step in the carcinogenic process)
- Beryllium metal did not directly damage the DNA of the cells
- Beryllium metal was not cytotoxic. (Cytotoxic testing is typically used to determine if a material is suitable for implanting in the human body or placed in contact with body tissues or body fluids on a long-term basis)

## REACH Studies Showed:

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- Beryllium metal does not cause skin irritation (OECD Test Guideline No. 404)
- Beryllium metal does not cause eye irritation (OECD Test Guideline No. 405)
- Beryllium metal does not cause skin sensitization (allergic skin reactions; OECD Guideline No. 406)
- Beryllium metal is not toxic by oral ingestion (OECD Guideline No. 423)

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## BeST's Activities

# Beryllium, A Critical Material and Key Uses in Europe



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## Beryllium a Critical Material

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**Beryllium has been designated by the European Commission as one of fourteen materials critical to the EU.**

A raw material is labeled “critical” when the risks for supply shortage and their impacts on the economy are high compared with most of the other raw materials

## Beryllium a Critical Material

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**According to the European Commission (European Commission Critical Raw Materials for the EU - Report of the Ad-hoc Working Group on defining critical raw materials, 2010):**

“The most significant threats originate from perceived risks associated with the use of beryllium in electronic products. EU regulatory fears and NGO propagated “banning” of the use of materials containing beryllium lead to unwarranted attempts to **find substitutes that do not offer the same qualities with respect to performance, sustainability and environmental protection.**

“In general, authorities are reluctant to **break from the past and are not open to new scientific studies even if they are conducted in accord with OECD guidelines or originate from proven workplace strategies.**”

## Beryllium Enables:

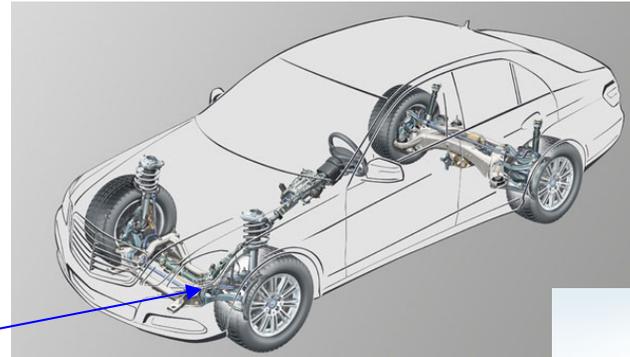
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- Miniaturisation (less waste)
- Energy savings (fuel and electricity)
- Gas and oil exploration
- Reduced raw material utilisation
- Reliability (less waste & very high degree of safety)
- Life-saving technology (innovation & advances in medicine)
- Green technologies

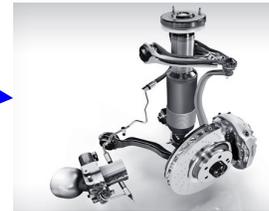
# Beryllium containing alloys are needed to make automobiles safe, reliable and desired worldwide.

## Reliability . . .

- Electrically conductive CuBe spring terminal contacts used in connectors for critical electrical and electronic systems in automobiles for safety and green technologies
  - Stability controls
  - Anti lock brake systems
- Engine control systems
  - Transmission systems
  - Radar and Infra Red sensors
- Green Cars Electric / Hybrid vehicles



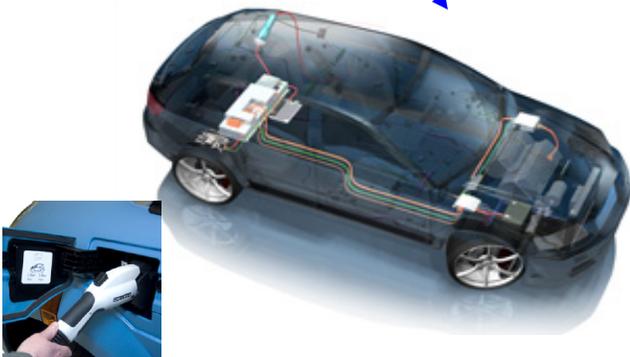
At the heart of it all –  
Copper Beryllium terminals



Engine sensors to control:  
Engine functions; fuel economy;  
Exhaust pollution

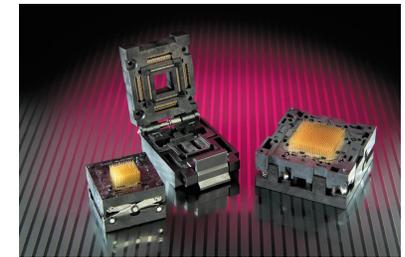


Sensors integrated to the auto controls by electronics



# Beryllium containing alloys make electronics small & reliable

- Electrically conductive terminals used as spring contacts for connectors used in mobile telephones, servers, computers, PDAs
- Electrical and electronic connectors and magnetic shielding in cell phones



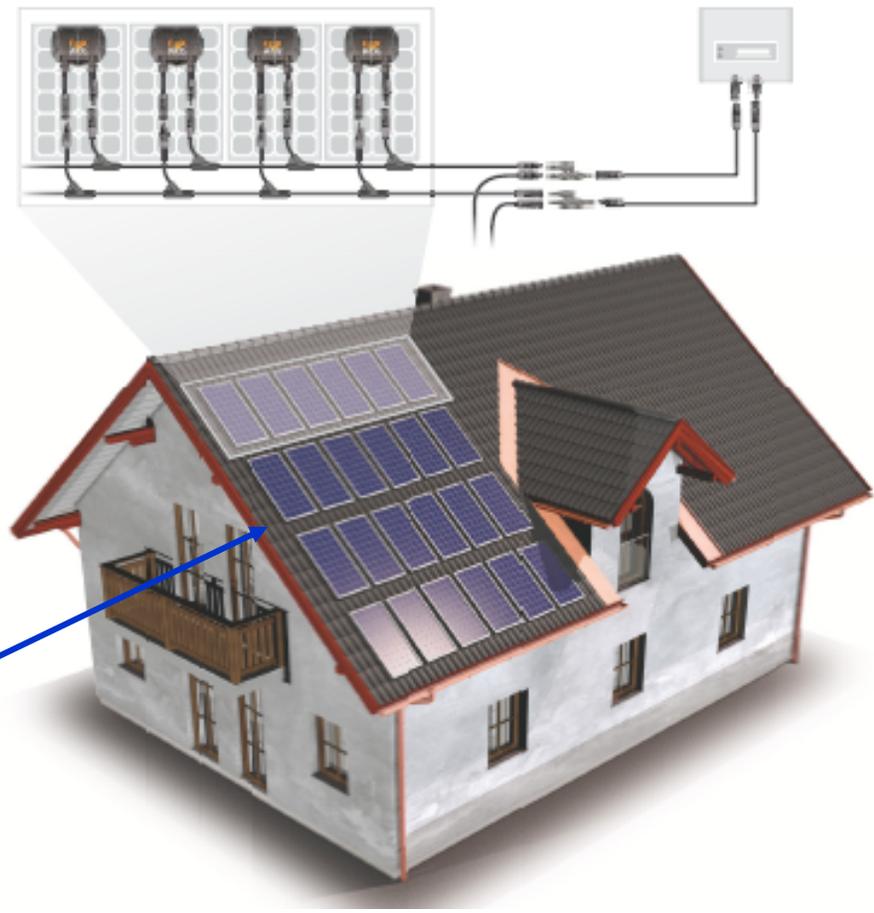
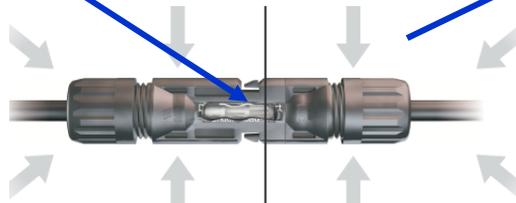
## Beryllium in home appliances give long, reliable service

- Electrically conductive terminals used as spring contacts for connectors in appliances such as air conditioners, refrigerators, water systems, dish washers, microwaves, etc.
- Connector terminals
- Sensors
- Thermostats
- Injection moulds & dies
- Circuit breaker switches



## Beryllium in solar energy survives the heat

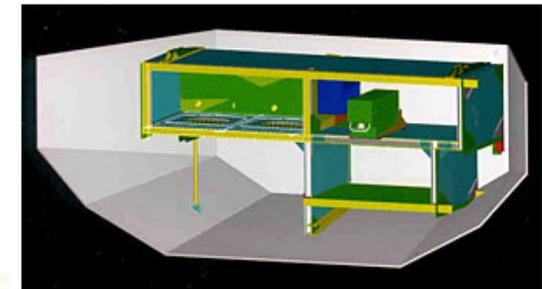
- Solar power photo-voltaic modules must remain connected together for over 20 years in temperatures from -30°C to +50°C, resisting:
  - Thermal expansion
  - Corrosion
  - Thermal stress relaxation
- CuBe Alloys connect reliably!



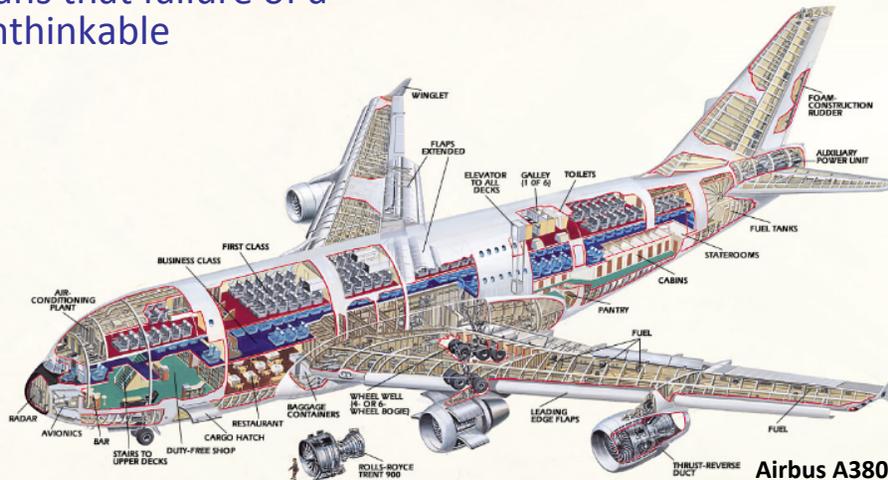
# Beryllium containing alloys are needed to make commercial aircraft safe and reliable

## Aviation = Safety & Reliability!

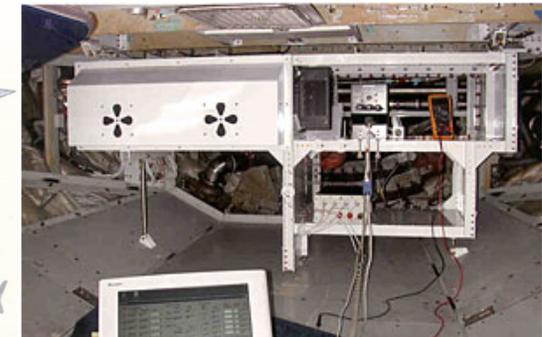
- Electrically conductive CuBe spring terminal contacts used in virtually all connectors for aircraft electrical and electronic systems.
- An Airbus A380 uses:
  - 530 km of wiring
  - 40,300 connectors
  - 2.9 million terminals
- Virtually all female terminals are made of CuBe alloys
- Fly by wire means that failure of a connector is unthinkable



Engineering design of electronic rack



Airbus A380

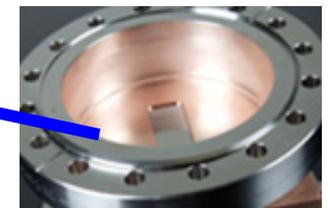


Electronic rack installed in aft cargo bay of Airbus

# Beryllium: Used for medical X-Ray windows & medical connectors

Uses the property of X-Ray transparency of Be

- Medical (Saves Lives)
  - CT Scan X-Ray Tube
  - Mammography & Biopsy (detection of small tumours)
  - Pharmaceutical
- Industrial & Analytical
- High Energy Research & Energy Alternatives
  - Particle Physics
  - Nuclear



Uses the reliability of CuBe in electronic connectors

- Medical equipment connectors terminals



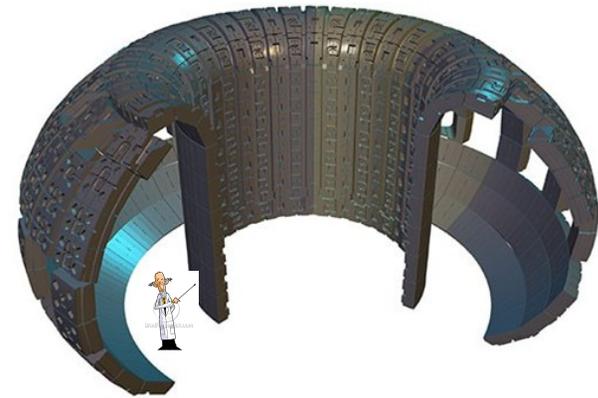
An X-Ray window made of Beryllium thin foil fastened to a stainless steel rim, incorporated into a CT Scanner.

# Beryllium used for non-nuclear energy generation

## JET: 20 years demonstrator use in UK - ITER under construction

- The ITER blanket is one of the most critical and technically challenging components in ITER: together with the Divertor it directly faces the hot plasma.
- Because of its unique physical properties, beryllium has been chosen as the element to cover the first wall.

Blanket



The entire inner first wall of the ITER reaction chamber is lined with beryllium tiles.

### Blanket Shield Modules

Labels in diagram:

- 4 PFW panels
- PFW 316L(N) SS backing plate
- PFW Cu alloy heat sink layer
- Beryllium tiles
- Shield block
- Recesses for module handling
- Access holes for coax. hydr. connector and module attachment system
- Access holes for PFW panel attachment
- Pipe for PFW panel cooling
- Recess for diagnostics
- Recess for electrical straps and coaxial hydraulic connector
- Recess for stub key

**Typical dimensions:  $1 \times 1-1.5 \times 0.5 \text{ m}^3$  ( $H_p \times L_T \times D_R$ )**

**Typical Mass: 4.5 t**

### Vacuum Vessel & In-Vessel Components

*Vacuum Vessel*  
*Blanket system*  
*Divertor System*

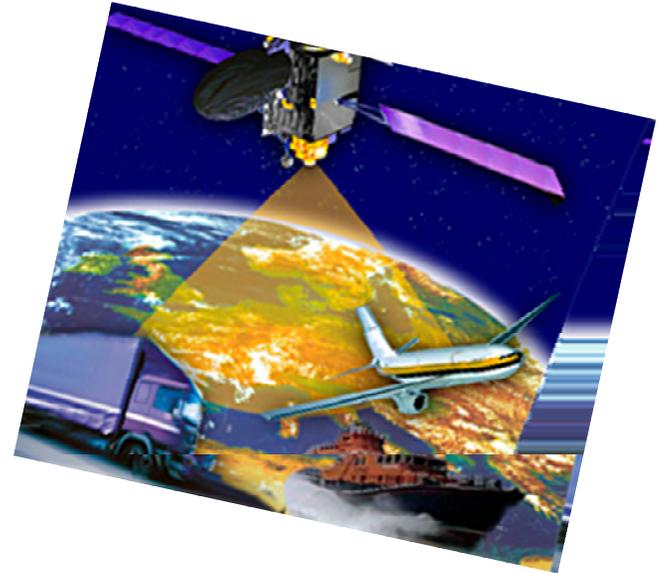
VV Parameters:	
Torus OD	19.4 m
Torus height	11.3 m
Double wall thickness	0.34-0.75m
Shell thickness	60 mm
Total Mass (9 Sectors)	6501 t
VV Mass	2395 t
+ shielding	2500 t
+ ports	1606 t

# Beryllium as a Vital Material for Innovation in Europe

## Beryllium is vital to the Galileo global positioning satellite project

According to the EU DG Enterprise & Industry:

- ➔ Galileo will underpin many sectors of the European economy through its services: electricity grids, fleet management companies, financial transactions, shipping industry, rescue operations, peace-keeping missions.
- ➔ Galileo is expected to deliver €90 billion to the European economy over a period of 20 years.
- ➔ European independence.
- ➔ Europe will receive a significant portion of the higher value adding work on the electronics and instrumentation packages for Galileo.



### Beryllium uses:

- Satellite structure
  - Strong light weight
  - Longer life due to > fuel load
- Electronic Connectors
  - Reliability

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*Thank you for your attention !*



Beryllium Science & Technology Association

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