The Strategic Importance of Beryllium to the European Union

- **The EU does not have any commercially viable domestic source of beryllium, and does not have any capability to process ores or raw materials of beryllium to beryllium metal or any of the alloys of beryllium. All such materials are imported in semi-finished forms that are processed to make engineered components for eventual inclusion in the manufacturing of end-use products.**

- **Three forms of beryllium are of strategic importance to the EU:**
  - **Metallic beryllium and alloys containing > 50% beryllium**
  - **Copper beryllium containing 0.25 – 2.0% beryllium**
  - **Al, Cu and Ni master alloys containing 2-15% beryllium**
  - **Beryllium Oxide ceramic**
- **Beryllium in all of its semi-finished forms can be recycled indefinitely, with considerable reductions in energy and carbon footprint compared to extraction from the ore. It is common to recover up to 50% of the supplied semi-finished material in the form of in-process scrap from the primary customers which is returned to the USA for recycling through comprehensive scrap collection chains. Once a beryllium containing component is imbedded in an assembly that is part of a larger piece of equipment, it forms such a small proportion (often less than 40 ppm) that it is not economically or technically feasible to recover. When beryllium containing materials are recycled, it is generally associated with recovery of the base metal where it ends-up in the slag stream.**
- **Since the first commercial uses of beryllium in the 1920's period, the EU has been reliably supplied by sources in the USA and more recently from Kazakhstan. The US source of beryllium has proven reserves of ore that can provide current world requirements for a minimum of 75 years, and there are similar sized deposits in several other locations in the USA that are currently not being exploited. No supply shortage is predicted.**
- **Examples of strategically critical applications that have been supplied to the EU with consistent reliability include :**
  - **1923 – Present: Copper beryllium alloys in thin strip and rod form for the manufacture of electrically conductive terminals of e.g.,**
    - **Relays used for telephone exchanges**
    - **Relays used for controlling industrial, domestic and automobile electrical equipment**
    - **Connectors for all electrical, electronic and telecommunications equipment and appliances**
    - **Pressure sensing diaphragms for aircraft altimeters, medical stethoscopes, barometers and automobile sensors.**
    - **Extremely long service life fire sprinkler water control valve springs.**
    - **Extreme reliability automobile connectors for air-bag crash sensor and deployment systems, anti-lock brake systems and all other high reliability applications.**
    - **Aircraft electrical and electronic connectors**
    - **Household appliance temperature and other function controls**
  - **1930 – Present: Copper beryllium alloys in thick plate, rod and tube form for the manufacture of e.g.,**
    - **Non magnetic equipment components used in oil& gas exploration and production equipment; directional drilling equipment; coal and minerals mining equipment; mine detection and minesweeping**
    - **Undersea cable signal amplification "repeater" housings.**

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- **Aircraft landing gear, control rod and wing aileron / flap bearing bushings.**

- **1930 – Present: Beryllium master alloys in the form of ingots, shapes and granules for the manufacture of e.g., Semi finished billets, slabs and castings, widely used in the EU as input raw materials to produce semi finished alloys; foundry castings; thin strip etc. which are used by a multitude of EU companies to produce such products as:**
  - **Aircraft components such as pitot tubes / low friction contact surfaces.**
  - **Space rocket components, e.g. as exhaust nozzles**
  - **High reliability components e.g. brake parts (non abrasive holders and clutches) in high speed trains**
  - **Electrode holders and components of welding robots for automated automobile and appliance welding**
  - **Property modifier for aluminium and magnesium casting alloys used to make components that are stronger, lighter and safer for applications like automobile and truck components while improving recyclability.**
  - **Plastic and metal casting moulds that improve productivity and product tolerances that maintain the leadership of EU producers.**

- **1930 – Present: Beryllium metal and alloys containing > 50% beryllium**
  - **X-Ray transparent windows used to control and focus X-Ray beams in all medical, scientific and analytical devices incorporating X-Ray sources.**
  - **Gyroscope gimbals and yokes for use in guidance, navigational and targeting systems used on aircraft, armoured vehicle and marine missile systems.**
  - **Satellite mounted directional devices for astronomical and other telescopes and instruments**
  - **Satellite structural components**
  - **Mirrors for terrestrial and space mounted astronomical telescopes**

- **1942- Present: Neutron and atomic particle control properties**
  - **World leading EU science and technology programmes depend upon beryllium for critical components that cannot be substituted by any other material.**
  - **A prime example is the JET Joint European Torus reactor at Culham in the UK. This is the largest magnetic confinement plasma physics experiment worldwide currently in operation**
  - **Beryllium is critical for the success of the large scale demonstrator ITER project located in Cadaraches, France that is designed to produce sustainable energy from non-radioactive nuclear fusion.**
  - **Medical isotope production nuclear reactors in Belgium, Holland and elsewhere in the EU produce critical isotopes for treatment of many types of cancer.**

- **1930 – Present: Beryllium Oxide Ceramics**
  - **Beryllium Oxide raw materials are used by EU manufacturers to produce ceramic components with extremely good thermal conductivity while providing electrical insulation, a unique combination of properties exploited for use in the manufacture of such equipment as:**
    - → **Substrates for mounting high powered electronics such as power amplifiers that need cooling to prevent self destruction**
    - → **Laser beam focusing and control.**
    - → **High power printed circuit substrates**
    - → **Klystron / magnetron components of microwave and radar devices**

- **Substitution to alternative materials is generally not an option, since the functionality would be lost or performance substantially impaired.**
- **If beryllium containing materials were not available to EU manufacturers, end users would replace the end use products with imported articles, thereby eliminating EU leadership in a wide range of high technology industries, with a concomitant loss of employment and skills.**
- **While there has not been even a single disruption to the supply of beryllium to the EU, there is a real concern that critical components and critical needs for beryllium will succumb to misguided and misdirected regulatory and legislative measures that are not supported by, and may even be in complete disregard of the most recent scientific data. As a result, there would be a trickle down effect where the EU would lose value adding high-technology jobs because end users would replace the end use products with imported articles.**
- **Virtually all of the employment related to beryllium is at Small and Medium Sized Enterprises (SEM), and in most of these are in many areas in which it is a world leader, such as:**
  - **Aerospace: Satellite structures and components, Aircraft landing gear and wing systems**
  - **Avionics: Aircraft / UAV and Satellite control systems**
  - **Oil & Gas exploration and production equipment**
  - **Mining and directional drilling equipment**
  - **Alternative energy equipment**
  - **Defence equipment**

  The need for beryllium has never been as evident as its need in the Galileo project. According to the 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, all depend heavily on satellite navigation technology. Galileo will make Europe independent in a technology that is becoming critical, including for strategic areas such as electricity distribution and telecommunication networks. Galileo is expected to deliver EUR 60 billion to the European economy over a period of 20 years in terms of additional revenues for the industry and in terms of public and social benefits, not counting the benefit of independence."

- ## The EU:
  - **Uses over 56,000 Kg / year of beryllium in all forms**
  - **In over 500 SME and 40 larger enterprises**
  - **Employing over 10,000 employees**
  - **Of which, 3,000 use beryllium in the workplace**