Beryllium Science & Technology Association

Brussels, November 2025

# Recycling of Beryllium: The Need for a Material-Specific Approach

## BeST Position Statement – Circular Economy Act

Beryllium (Be) requires a tailored, material-specific approach to recycling due to its unique technical properties, economic considerations, and specialized applications. Key realities include:

- **Limited recycling of pure Be** primarily due to its use in space, energy, and defence applications.
- **Recycling from production scrap:** partial closed-loop recycling of copper-beryllium (CuBe) alloys into new CuBe alloys, with rates of ≈30–40%.
- **Recycling from post-consumer waste:** embedded CuBe alloys are small-sized and contain low Be content (<2%), making isolated Be recycling technically infeasible, and both economically and environmentally unjustified.
- **Trace Be presence in magnesium (Mg) and aluminium-magnesium (AlMg) alloys (5–10 ppm)** renders isolated Be recycling infeasible.

The Beryllium Science and Technology Association fully supports the EU's transition to a circular economy and recognizes that enhancing the circularity of critical raw materials is vital for resource security and environmental sustainability. At the same time, beryllium's specific applications and economic considerations require a differentiated, material-specific policy approach.

**End-of-Life Considerations for Beryllium (Be)**

**Pure Be metal components** account for ≈15% of global consumption and are already recycled as much as possible due to their high intrinsic value and the significant energy savings, ≈70% compared to primary production, that recycling provides. However, two major factors limit broader circularity:

- **Longevity:** due to their exceptional durability, pure Be metal components stay in use for decades, meaning they re-enter the recycling stream very slowly.
- **Application Constraints:** pure Be metal components are often used in applications where recycling is infeasible due to location or condition:
  - **Space**: Be used in space applications remains beyond reach.
  - **Energy & Research**: Be used as a neutron reflector becomes irradiated.
  - **Defence:** Be used in military applications faces security-related restrictions.

**CuBe alloys** represent ≈80% of global consumption, showing unmatched strength and conductivity. Below points should be considered when deciding on recyling pathways:

- **Closed-loop recycling from production scrap:** producers recycle both own and customer production scrap, achieving a recycling rate of CuBe alloys of ≈30 to 40%.
- **Size & volume constraints regarding post-consumer waste:** CuBe alloys are primarily used in small-sized, embedded components such as electrical connectors, which makes isolated Be recycling technically, economically, and environmentally unviable. Containing less than 2% Be and representing only ≈0.15% of all Cu alloys, isolated Be recycling provides no tangible economic or environmental benefit. Instead, CuBe alloys are recycled along with other Cu materials, where the Be becomes highly diluted in the Cu stream and has no impact on the quality of the recycled Cu.

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**Be plays an essential role as an additive in the production and recycling of Mg and AlMg alloys**. Typically introduced through an AlBe master alloy containing 5% Be, it stabilizes the process and controls oxidation during smelting and refining. To prevent oxidation and ignition, Mg and AlMg alloys must contain 5–10 ppm Be. At these trace levels, Be remains fully dissolved in the alloy matrix and can therefore not be isolated for recycling by any known metallurgical process. Nevertheless, its controlled addition is essential for ensuring the safe and efficient production and recycling of Mg and AlMg alloys within the EU.

**Considerations for Beryllium (Be) Containing Production Scrap**

For Be-containing materials, the European market remains too limited by volume to justify the substantial investment required for dedicated recycling infrastructure. Moreover, due to the specific nature of Be, the recycling of CuBe production scrap necessitates highly specialized facilities; further increasing investment costs. Therefore, CuBe production scrap recycling continues to rely on specialized facilities outside Europe, particularly in Japan and the United States.

**Policy Recommendations and Path Forward**

Considering the above realities, Be should not be subjected to uniform recycling requirements due to its unique technical properties, limited circular potential, and essential role in high-technology applications. Primary production remains indispensable for sectors where recycling is technically infeasible or logistically impractical, which is the case for those depending on Be.

BeST urges the EU to ensure that circular economy policies are **science-based, proportionate, and realistic**. Rather than imposing blanket recycling targets, policy should:

- Recognize the **technical and economical limits of recycling** for Be-containing materials.
- Maintain access to **primary Be production** as a strategic necessity for Europe's industrial resilience.

BeST stands ready to provide data, sectoral expertise, and constructive dialogue to help shape an EU Circular Economy Act that is both technically feasible and economically viable.

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**About BeST**

The Beryllium Science and Technology Association (BeST) represents the manufacturers, suppliers and users of beryllium metal, beryllium containing alloys and beryllium oxide ceramics in the EU market. BeST has the objective of promoting sound policies, regulations, science and actions related to the safe use of beryllium and to serve as an expert resource for the international community on the benefits and criticality of beryllium applications. It is also the objective of BeST to promote good practices in the workplace to protect workers handling beryllium containing materials.