BeST
Beryllium Science & Technology Association

Beryllium Safety Bulletin

Safety Practices for Machining Copper Beryllium Alloys (Drilling, Boring, Milling, Turning, Tapping, Reaming, Sawing, etc.)

Copper beryllium (CuBe), in solid form and as contained in finished products, presents no special health risks. Most manufacturing operations, conducted properly on well-maintained equipment, are capable of safely processing copper beryllium-containing materials. However, like many industrial materials, copper beryllium may present a health risk if handled improperly. The inhalation of dusts, fumes, or mists containing beryllium can cause a serious lung condition in some individuals. The degree of hazard varies, depending on the form of the product, how it is processed and handled, as well as the amount of beryllium in the product. You must read the product specific Material Safety Data Sheet (MSDS) for additional environmental, health and safety information before working with copper beryllium containing materials.

SOURCES OF EXPOSURE

Machining - Copper beryllium is a ductile metal that machines easily, generally producing large chips and turnings. Processes that generate large particles are usually performed in an open shop environment with no special ventilation or housekeeping practices required. Machining processes that do generate small particles must be controlled with appropriate work practices and engineering controls. The following table provides a summary of those processes that typically present low inhalation concern (green) and those that may present a likely inhalation hazard (yellow).

Low Inhalation Concern Machining Operations		**Likely Inhalation Hazard Machining Operations**	
Stamping	Deburring (non-grinding)	Sanding	Coolant Management
Sawing (band or tooth blade)	CNC Machining	Grinding	Ventilation Maintenance
Drilling	Wet Machining	Polishing	High Speed Machining
Slitting	Hand Filing	Buffing	Deburring (grinding)
Turning	Tapping	Honing	Abrasive Blasting
Milling	Reaming	Abrasive Sawing	Electrical Discharge Machining (EDM)
Boring		Lapping	

1) Operations in the “Low Inhalation Concern” category represent operations that typically release non-respirable (>10 micrometer) particles, are not expected to generate significant ultra-fine particulate, and/or are not expected to result in exposures in excess of the recommended Occupational Exposure Limit (OEL) of 0.2 µg/m^3.
2) Operations in the “Likely Inhalation Hazard” category represent those operations which may release respirable (<10 micrometer) particles, may generate ultra-fine particulate, may generate beryllium oxide and/or may result in exposures in excess of the recommended OEL of 0.2 µg/m^3.
3) This list is not all-inclusive and variation can exist within specific processes. Determine, then verify, the adequacy of engineering and work practice controls by conducting an exposure characterization of all copper beryllium processing operations.
4) Effective ventilation, work practices and personal protective equipment use can control a “Likely Inhalation Hazard”.
5) When evaluating operations, consideration must be given to potential exposures from activities in support of these operations such as setup, preparation, cleanup and maintenance.

WORK PRACTICES & CONTROL MEASURES

Some combination of the following control measures may be required when machining copper beryllium alloys:

Wet Methods

- The proper use of machining lubricants as a flood or in heavy flows is usually an effective method for controlling the airborne generation of copper beryllium particles.

- Care should be given to lubricant containment that prevents excessive splashing onto floor areas or operators' clothing.
- Inadequate coolant flow and higher tooling speeds may require additional containment and ventilation controls.
- Please note that the recycling of liquid lubricant/coolant containing finely divided copper beryllium in suspension can result in the concentration building to a point where the particulate becomes airborne during use.
- Machining lubricant should be filtered, settled, centrifuged or changed regularly to reduce the accumulation of fine particles.

Exhaust Ventilation

- Local exhaust ventilation is not necessary for machining processes which produce only large (>0.0005"), non-respirable chips.
- Local exhaust ventilation must be used on dust-producing operations when lubricants or coolants are not being used or are not effective in controlling the release of airborne dust.
- The type and capacity of local exhaust ventilation required will depend upon the speed of particle generation. For example, hand sanding operations produce relatively slow moving particles, while powered grinders and roto tool operations produce very fast moving particles.
- Positioning of a close capture, high velocity ventilation duct/hood at the point of particle generation on a stationary grinder is critical to the system's effectiveness. The duct/hood must be positioned as close as possible to the source and in line with the direction of particle travel.
- The dust generated when using handheld grinders or roto tools can be very difficult to control due to the random nature of particle generation. Handheld grinders and roto tools are generally used in a ventilated partial or full enclosure designed to draw particles away from the operator. Alternative methods to hand grinders, such as filing or wet sanding, should be used where possible.
- Disruption of the airflow in the area of a local exhaust inlet, such as by a man cooling fan, should be avoided.
- Ventilation equipment should be checked regularly to ensure it is functioning properly.
- Ventilation training is recommended for all users.
- To be effective, ventilation systems should be designed, installed and maintained by qualified professionals.

Speeds/Feeds/Tooling

- These machining variables must be considered when determining the extent and type of engineering controls and work practices which may be required.
- Similar to the machining speed discussed above, stock feed rates can be an important factor in determining whether a process will generate airborne particles.
- Tooling condition is another important variable. Sharp-tooled machining processes generally produce only large chips while dull tooling may produce a mixture of large and smaller chips.
- Strict control of process speeds/feeds and tooling condition will assist in reducing airborne particle generation from machining processes.

Respiratory Protection

- Whenever possible, appropriate work practices, use of local exhaust ventilation or other engineering controls are the preferred methods for controlling exposure to airborne particles. When these methods are ineffective, or are being developed and potential exposures are above the occupational limits, approved respirators must be used as specified by an Industrial Hygienist or other qualified professional.
- Respirator users must be medically evaluated to determine if they are physically capable of wearing a respirator.
- Quantitative and/or qualitative fit testing and respirator training must be satisfactorily completed by all personnel prior to respirator use.
- Users of any style respirator must be clean shaven on those areas of the face where the respirator seal contacts the face.
- Pressure-demand airline respirators are required when performing jobs where a potential for high exposure exists, such as changing filters in a baghouse air cleaning device.

Protective Clothing

- Protective overgarments or work clothing must be worn by persons who may come in contact with dusts, fumes or

powders during activities such as grinding, sanding, furnace rebuilding, air cleaning equipment filter changes, maintenance, furnace tending, etc.
- Used disposable clothing should be containerized and disposed of in a manner which prevents airborne exposure during subsequent handling activities.
- Contaminated work clothing and overgarments must be managed in such a manner to prevent secondary airborne exposure to family or laundry personnel handling soiled work clothing.
- Never use compressed air to clean work clothing.

Housekeeping

- Copper beryllium machining equipment and associated support systems (e.g., dust collectors, heat treat furnaces, coolant trays and reservoirs) should be cleaned on a regular basis to prevent the accumulation of copper beryllium-containing materials.
- The use of compressed air or brooms for cleaning dust must be prohibited. Such activity can result in unnecessary airborne dust exposure.
- Wet cleaning and vacuuming are effective methods for cleaning machining and support equipment.
- Rags, towels or wipes used to dry or wipe parts clean should not be allowed to dry and must be maintained in a closed container. Rags and towels should not be reused. They should be containerized and disposed of in a manner which prevents airborne exposure during subsequently handling activities.
- Portable vacuums should be of a type equipped with High Efficiency Particulate Air (HEPA) rated filters.

Maintenance

- Under certain conditions, the repair or maintenance of equipment can generate airborne particles.
- Protecting workers can require the use of specific work practices or procedures involving the combined use of ventilation, wet and vacuum cleaning methods, respiratory protection, decontamination, special protective clothing, and when necessary, restricted work zones.
- Detailed procedures for safely maintaining the process equipment and ventilation systems should be developed.
- All operators and maintenance personnel need to be trained in the established procedures prior to performing maintenance or service activities. The procedure should detail the use of wet methods or vacuuming, ventilation and appropriate personal protective equipment required to prevent exposure to airborne particles.

Workplace Exposure Characterization

- Air samples should be taken for all operations where a potential for beryllium exposure exists.
- Air monitoring is the primary method for determining the degree of exposure and effectiveness of engineering and work practice controls.
- Characterization of worker exposure should only be performed by trained personnel.

Recycling

- Copper beryllium machining scrap should be kept segregated from other metals to retain its higher value as a recyclable material.
- Product importers and producers purchases clean, segregated copper beryllium scrap.

Disposal

- Copper beryllium wastes are not considered hazardous under most member state regulations.
- When spent products are declared solid wastes (no longer recyclable), they must be labeled, managed and disposed of in accordance with federal, state and local requirements.
- Some copper beryllium products contain specific metals (e.g., chromium, lead) that are regulated waste materials.

ADDITIONAL INFORMATION

If there are concerns about potential beryllium exposure in your workplace, contact an industrial hygienist or other qualified occupational health and safety specialist to perform a workplace assessment and exposure characterization.

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The information contained in this Beryllium Safety Bulletin applies only to the subject referenced in the title. Read the safety information provided to you by the supplier for more detailed environmental, health and safety guidance specific for the products in use at your facility.

Additional information may also be available by contacting:

Beryllium Science and Technology Association (BeST)
Rue de l'Industrie 4
B-1000 Brussels
Tel: +32 (0)2 213 74 20
E-mail: info@beryllium.eu
http://beryllium.eu/